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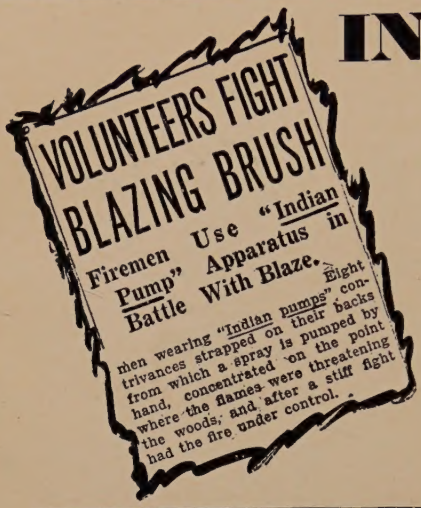

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JOURNAL OF FORESTRY

VOL. XXXIII NOVEMBER, 1935 No. 11

EDITORIAL

WILD LANDS

WHEN New York inaugurated its forest policy in 1885, the state legislature decreed that "the lands now or hereafter constituting the forest preserve shall be forever kept as wild forest lands." In 1894 virtually the same words were embodied in the state constitution. The original law fortified the "forever kept" by specifying that the lands could not be sold, leased, or taken by any corporation, public or private. The constitution further bulwarked this by including the word "exchanged"; but its principal difference from the legislative prescription concerned the interpretation of the phrase "wild forest lands."

In common American usage, "wild" lands are lands that have not been "improved," or brought under cultivation; and it was probably in this sense that the word was used in the original law. But the term sometimes carried the meaning of "wilderness lands"; and this more nearly expressed the purpose of many of those who urged the legislation. From the outset it was supported by two groups. Men like Sargent, Hough, and Fernow had in view forest management; men like Verplanck Colvin and most of the New York City advocates of the bill, a state forest park. In 1894 the latter group, justly alarmed by the imminent danger of extensive, ill-advised, and silviculturally unsound timber cutting, took the lead in getting through the constitutional amendment, which concluded:

"nor shall the timber thereon be sold, removed, or destroyed."

Thus the "wild lands" of New York's forest preserve became dedicated to wilderness preservation. But the outcome and present trend might be startling to those who wanted to save the wilderness of their day.

They were primarily concerned for the Adirondack region, which had long been known as "the Adirondack Wilderness," or "The Great North Woods." Down to about 1850 it had been in the fullest sense of the term a wilderness; and though both lumbering and the first summer accommodations for city people began to develop at that time, their early effect was unappreciable. Roads were few, entry was by long stagecoach trip, the villages were small, scattered, and primitive, the life was simple, and the lakes, woods, and mountains afforded an almost unbroken solitude. The next fifty years brought, it is true, great changes—the luxurious "camps" of the wealthy, great private estates, rail travel, fashionable summer resort hotels, thronging visitors of all sorts; yet in the main, for those who sought the ways and life of the

wilderness, the Great North Woods was still there.

Today, the Adirondacks is an intensively used, highly developed summer and winter mountain playground. The last fifteen years have been the period of swiftest change. It was illustrated in September by the dedication of a memorial highway to the top of Mount Whiteface, up which visitors may now speed effortlessly in high gear, to get the magnificent view. The dedication was by President Franklin Roosevelt. It was on his way down from an all-day climb of Whiteface in September, 1901, that Theodore Roosevelt received the message which called him from the woods to the Presidency.

Public policy has to confront, again and again, in endless succession and multitudinous forms, essentially the question that the automobile highway to the top of Whiteface raises; which in turn is not unrelated to the question of the feasibility and desirability of wilderness preservation. Paved roads are cutting through the Maine wilderness; skyline drives are advocated for the White Mountain Presidential Range and the crest of the Green Mountains; the Great Smokies are being opened to the automobile; the Blue Ridge in Virginia and the North Carolina mountains as far as the Great Smokies are to have their continuous "skyline drive" 600 miles long; and the C.C.C. and other emergency relief road and trail building is honeycombing the public forests from ocean to ocean with its penetration. Outdoor recreation, for the most part in connection with the use of the automobile, has become a national habit; today we are a people on wheels, and we may soon be a people on wings. And wherever rare scenic beauties are known to exist, there straightway the multitudes want to go; and they demand access, accommodations, and the conveniences of civilization—not to mention some of its monstrosities.

Local interests are, in the nature of the case, sure to clamor for "development." The economic hope of New Hampshire—its major dependence for stemming the tide that sets toward rural depopulation, falling property values, decreasing tax revenues, and land surrender to involuntary public ownership—lies in the field of recreational visitors and summer residents. People press for National Parks in their neighborhood to benefit by the expenditures that throngs of sightseers will involve. The few scattered settlers who worked their way gradually into the Adirondack region in the first half of the nineteenth century were wilderness lovers, or they would not have gone there and real woodsmen; but they gave glad welcome to the coming of the city visitors, enterprisingly enlarged the accommodations for them, and in some cases grew rich providing for their needs. In short, while the idea of wilderness preservation receives wide popular acclaim, its actuality accords neither with local desires nor with the thirst of the public for entrance to and facile enjoyment of the loudly sung charms of unspoiled nature.

Thus public forest and park administration is constantly put under pressure for a piecemeal breakdown of successive dedications of "wild lands" to the purpose of wilderness preservation. How thoroughly has been defeated that undoubted purpose of the early enthusiasts who engineered New York's constitutional prohibition of timber cutting in the preserve, the bare facts and figures of present-day use and development eloquently attest. The construction of well marked trails and open lean-tos and the provision of large tourist campsites was entered upon by the state only fifteen years ago. In 1934 there were more than 500,000 registrations at the 28 large campsites then open. Some of these campsites have almost city conveniences; a recent state publication cites as an example the Fish

Creek Ponds camp, with 500 separate fire places; sanitary toilets; driven wells for fresh water; free fire wood; meat, grocery, milk, and laundry delivery; and swimming, boating, and parking facilities. There are 127 open lean-tos, and 600 miles of trail; and the estimated grand total of visitors is put in the millions. "This recreational development," the account concludes, "has not been surpassed nor equalled by any other state in the Union."

The fact must be faced that in the long run and for the most part, the wilderness is bound to disappear. No matter how strong may be the desire of public authorities to preserve in their natural unspoiled condition large areas of "wild lands" replete with scenic attractions of the finest and noblest kind, to be looked upon only by the few physically, temperamentally, and financially prepared to undergo the effort that is nature's price of admission to her innermost shrines and guarded heights, the every-day citizen-voter, taxpayer, and property owner is going to demand, and eventually force, "development." Even though there were no pressure of public opinion to be resisted, there are other considerations. One concerns popular support. Visitors by the hundreds of thousands instead of by the score mean friends, influence, prestige, and funds. In addition, a hard question of relative values is involved.

To look from the summit of a great mountain peak attainable only at the cost of strenuous climbing, and to stand there as though alone in a silent world, gives a rare elation. In part, it is a sense of something conquered. To have looked into the vast chasm of the Grand Canyon when one had to ride many miles across the desert to do it would have been an experience of a lifetime. No intrusion, then, of shallow-pated chatterers to break the great spell. Yet who would bar from sight of the Grand Canyon the thousands upon thousands who can now yearly debark from the Pullman upon its rim? Or how weigh one against the other the relative public values of Whiteface, or Mount Washington, or Pike's Peak with and without means for the many to ascend them?

There is no simple answer to this complex problem of where to permit and where to resist "development," in the best public interest. Rather, the effort should be to decide each case on its merits at the time. The friends of the wilderness and the advocates, interested or disinterested, of widened opportunities for mass recreation will join issue successively over this and that area of relatively primeval conditions; over one effort after another to give the automobilist a new road and a new reason for touring. On the whole, "development" will go on gaining victories; the public will have its way, and the vast majority of the public wants more places to go and has slight interest in the preservation of treasures to which it is not admitted. Whether its altruism in this particular can be materially increased by any educational effort may be questioned. Nevertheless, the effort should be made.

But it should be made on sound grounds. There is danger of loose thinking in this whole field. The question calls for further discussion, in another number of the JOURNAL.

FORESTS, LAND AND WATER

By GEORGE B. GORDON

Acadia National Park, Bar Harbor, Maine

THE State of Maine, like others of the New England states, is primarily an area of forest, wild lands, and water. Along its eastern coasts are a few moderately populated cities; along its highways are a few towns and scattered farms to a short distance inland from the sea; but as you look on the map towards Canada you see lakes and streams and vast areas of blank space where the only names are those of bodies of water and mountains.

Years ago the lumbermen went into these open spaces on the map, cut the timber and rafted it down these streams and lakes to the mills. The lumbermen followed the virgin timber to the South and West, and after the lumbermen came the pulpwood operators, who are still here and still harvesting crops of pulpwood,—*as often as they mature.*

Thanks to tree species and combinations of soil and rainfall which produce abundant reproduction after cutting, and often even after fire; and thanks to paper company operators who refuse to quit, in spite of most discouraging market and business conditions, the Maine Wilderness is still a going concern. But there are problems here which will repay study by the forester.

There are three fundamental angles of the problem of "Forest Managament" as it has been practiced:

First, that the management of timberlands has almost invariably been concerned only with the growing and cutting of timber and its transportation, manufacture and sale as a manufactured product.

Second, that the development of other sources of income from timberlands has never been seriously attempted by the majority of forest land owners, in Maine or any other New England state, on any considerable scale.

Third, that the development of fish, game and other recreational resources does not interfere with the original purposes of forest land management, and furthermore may well produce income (*annual income at that*) from "heath" lands, cutover lands, and areas of water from which (except for the production of hydro-electric power) income has rarely if ever been expected even by the most successful operators.

Let us consider the relation between fish and game and land values.

1. A major industry in the State of Maine is the operation of hunting and fishing camp facilities. Good hunting and fishing are the important factors in the success of such operations.

2. The value of wilderness lands on good trout or salmon streams or lakes will always be much higher than elsewhere; in other words, a tract of land which controls access to and camping facilities on a lake or stream has a sale value in direct proportion to the excellence of the fishing for trout, salmon or black bass.

3. The point which is apparently not well understood by most forest land owners is that by systematic handling of wild lands, wild life values may be immensely increased.

Wise management must include: methods of cutting which will not decrease wild life; a reduction to an absolute minimum of the number of dams in streams, with well designed fish-ways on all dams which remain; and adequate

measures taken to increase food and cover for wild life on land and water.

Due to low prices for plupwood ($7 is the latest quotation for a cord of peeled pulpwood) the average timber land owner in Maine cannot afford to do anything but "get the wood out." It is apparent that slash disposal, or even top lopping of the simplest kind, is almost out of the question. It is not *good business,* however, to leave heavy slash lying at the very edge of highways or main logging roads. Without additional cost, trees can be felled away from these roads, where a single match tossed by a careless smoker will destroy future timber, and cover and food for game as well.

The number of dams on the streams of Maine is beyond any counting. The Atlantic salmon has been almost exterminated by dams in the larger rivers. In almost every large creek, dams, erected by timber operators, have cut off the trout from the headwaters. Fishways on permanent dams are now required by state law, but the horse from that stable was stolen years ago. If timberland owners will merely open sluice gates, or dynamite abandoned dams, the minimum of restocking now being done by the state will bring back the trout.

The common practice of raising the level of lakes by dams at their outlets has increased water temperatures, and otherwise created unfavorable conditions for trout. The resulting flood of marsh lands has destroyed food and cover for wild ducks. The lumberman must understand that permanent changes in the water level always affect fish and game, and rarely better conditions for wild life. Dead timber on lake shore lines always follows the erection of such dams, and dead timber decreases the recreational value of the land.

Time does not permit the enumeration of many common practices by woods operators which tend to reduce both the value of cut over lands and the fish and game on them. It is submitted, however, that nothing will accomplish so much toward the permanency of woodland values and the increase of fish and game as a policy of leaving alone during cutting operations the shores of lakes and streams, and road and trail borders. The writer recalls a logging operation in northern New York, which cost an owner just fifty thousand dollars in the loss of a sale of the land for recreational purposes. The sale was being negotiated on a basis of cutover land; but with the shore lines on the lakes cut off, the sale did not go through. And incidentally, those shore line areas were the nesting grounds of grouse, ducks, and other species of game.

In conclusion, three typical woodland properties will be discussed, which illustrate the results of management or lack of management of wild lands.

First is a hundred acres farm (70 acres of it are timbered) near Livingston Manor, New York, which includes some 3 miles of the famous Willowemoc Creek. This stream produces daily a net income of $1.00 per rod, over a four months' period. On a basis of 8 rods per mile per day, this means a net annual return of not less than $1,800 from fees alone. Incidentally, under capable management the stream is furnishing much better sport than was the case seven years ago, when the writer first learned of the project.

Again, a tract of dry upland in this same region of New York State produces a return in rental for hunting purposes of $400 for some 2,000 acres of cut over territory. No attempt has ever been made to "manage" this area in any way. With the annual expenditure of the several hundred dollars surplus after taxes have been paid (taxes average some five cents per acre per year) this rental could probably be greatly increased within a few years. The development of a good

trout stream flowing diagonally across the property (a stream now choked with logging debris and alder growth, and inadequately stocked) would mean a large increase in returns. The tract now does not pay its own carrying charges from the standpoint of timber production. Under management of fish and game resources, which would include the maintenance of logging roads now open along the stream as a partial solution of the fire protection problem, this 2,000 acre tract would become a going concern, many times more valuable than as a producer of second growth timber only.

A third and "horrible example" of failure to realize the possibilities of fish and game management on forest lands, is a series of tracts of cutover woodland in eastern Maine, completely encircling a lake some six miles long. Here the lake itself is the magnet which once attracted a capacity group of sportsmen, who from the opening of the fishing season about May 15th to the end of the duck hunting season, November 30th, kept a group of guides continually employed. The operation of camp and clubhouse facilities provided the means for collecting hunting and fishing "fees." The point is, that without superior hunting and fishing, the continued existence of plentiful landlocked salmon and black duck, these facilities have little value. Because of the lack of a definite stocking program in proportion to the number of fishermen, the fishing has not improved. Because no definite plan has been adhered to in developing a food supply for native and migrating ducks, and in limiting the daily number of sportsmen using the property, the shooting gradually diminishes. In the face of an increasing public demand for this type of sporting development, it becomes apparent that a wise program, which would have included a careful study of lake and shoreline conditions with the thought of increasing the food supply for both duck and fish "crops," would have assured the permanency of the development. Such a study must also have included a careful survey of game and fish conditions, to determine the maximum number of sportsmen who could be accommodated without overgunning or overfishing the area. The rather questionable practice of artificially feeding and attracting ducks to areas where blinds were located merely served to bring ducks to the guns; no provision was made for increasing the food supply *during the nesting and breeding seasons*, when the increase of game could actually have been effected. As said before, no policy of any kind is in force regarding the improvement of fishing conditions.

The project at present comprises some ten thousand acres, which continue to return considerable annual net income to the owner and lessee of the cut over lands involved. Just as the land was originally clear cut of fine stands of spruce and pine, so the fish and game crops are being "mined," until, a few years ago, the sportsmen began to desert this area and go to others less accessible, where comparatively virgin conditions allow fishing and hunting which can no longer be provided here, because of an all too usual policy of "destroy and get out."

The laws of several eastern states now permit the business management of game preserves, the rearing and stocking of fish and game, and the levying of fees for hunting and fishing. This is the logical outcome of the movement to increase game and fish resources by the use of private capital. The forester who would keep abreast of the times can learn much by the study of conservation methods used by a number of fishing clubs on the Beaverkill River, in the Catskill region of New York, and by such commercial ventures as the Erskine preserve in New Jersey.

The State of Maine must eventually

modernize its laws in regard to the management of fish and game resources. At the present time it has an outstanding fish and game department, which is doing a fine piece of work in rearing trout and salmon. The research, however, upon which depends the final solution of the problem of permanent increase of the state's fish and game resources, is held back by lack of an informed public and property owners group. The forester, by studying fish and game in the field, and by using the knowledge so gained to interest the private owner in developing the fish and game values of land, can accomplish much. He may be certain of a permanent place of honor in the economic history of the state. He may also develop for himself a source of livelihood in an area where few foresters are now permanently employed by private timber holders.

The writer is certain that once we foresters have demonstrated that we can not only grow forests, but use land and water as well, our future as a profession will be secure. The owner of wild lands must and will have annual returns from his properties. Let us help him to produce trout and salmon, grouse and deer, as well as timber.

SHOULD LARGE AREAS OF PRODUCTIVE FOREST LANDS BE DEVOTED SOLELY TO A LIMITED RECREATIONAL USE?

By GEORGE L. DRAKE[1]

The following paper was presented before a meeting of the Puget Sound Section of the Society last May. It was called forth by the proposed legislation to take 404,270 acres from the Olympic National Forest and combine this land with the present Mount Olympus National Monument to create the Mount Olympus National Park, with an area of 703,000 acres. Approximately 13 billion board feet of merchantable timber would thus be withdrawn from the western part of the Olympic Forest, in addition to 3 billion feet already included in the present Mount Olympus National Monument. The timber backlog of Grays Harbor and other industrial centers of the Olympic Peninsula would be reduced by nearly one half. The questions of principle thus raised are of broad general interest as well as serious locally. Mr. Drake presents the point of view of those concerned for the economic consequences of heavy industrial curtailments.

ANY consideration of the relationship of forest lands held for recreational use to forest lands in general should be based both on the demands of existing industries for raw products from the forests and on the demands of the public for recreational use of forest lands.

This discussion is concerned with the forested lands of western Washington. In this region the lumber industry has been since the settlement of the country, and will be for many years to come, the basic industry that will provide the payrolls and support local government. In considering the withdrawal of merchantable timber from use by including it in recreational areas in which cutting will not be permitted, we should first consider the effect such withdrawal will have on the major industry of western Washington.

Studies that have been made of the merchantable timber available to industry indicate that the supply of timber that can be economically handled is limited, and in certain areas, such as the Grays Harbor district, the situation is such that this problem is causing serious concern.

Efforts are being made by the federal government and those interested in the welfare of forest industries to work out cutting plans whereby under sustained yield management stabilization of the timber supply can be assured. It is recognized by those who have attempted to study this problem of sustained yield management that even under such a plan there will be a marked decrease in timber production, and that certain communities that have been developed through lumbering must suffer a serious decline. Another point that has developed in these studies is the necessity of including all the merchantable timber on the west side of the Olympic Peninsula in such plans in order to provide timber to carry on these industries until such time as the young growth on the cut-over and burnt-over areas become of merchantable size.

If the highly desirable objective of sustained production is to be attained, it is essential that this backlog of merchantable mature timber be kept available so that it can play its part in the working out of such a plan. To tie up any appreciable amount of timber in parks or reservations where it could not be cut would be a serious mistake, and work a real hardship on the people who are dependent today, and will be for many years to come, on the lumber industry. There is

[1]General Superintendent, Simpson Logging Company, Shelton, Washington.

also to be considered the economic loss involved when large amounts of merchantable timber are allowed to go to waste through decay, for timber is a perishable resource and it is not sound economics to allow such material to be wasted when it can serve a useful purpose to mankind unless fully compensating gains can be shown on the other side of the ledger.

The policy with reference to the use of productive forest lands for recreational purposes, should be governed to a large extent by the actual use that the public will make of these lands if they are reserved for that purpose alone. Any area in the Olympics should not be treated the same as a like area in New Jersey. In New Jersey the people of the state do not depend on the forests of that state for their livelihood. A survey of the industries of that state would, I think, reveal that forest industries are among the lowest on the list. Much of the upper country in New Jersey, along the Pennsylvania and New York line, is timbered with a scrubby growth of oak and pine, of little value except for cord wood, but these wooded areas are of considerable value for recreational purposes, due to their nearness to the great metropolitan centers. Every Sunday and holiday these state parks and adjacent parks along the Hudson in New York are crowded with people. The dedicating of these lands to recreational use must be conceded by all as worth while. On the other hand, in western Washington, where Nature has been very lavish with scenic ocean beaches, lakes, rivers, and mountains, such an area is not needed nor justified. Within a short driving distance of any community in this region there are natural attractions to please the various types of nature lovers.

Our mountain ranges are so rugged that logging over large portions of them will never be practical, and the recreationist who desires to visit wild spots can always have his desires gratified. The summit of the Cascades and the backbone of the Olympics will always be a vast wilderness area for the enjoyment of the hardy recreationist.

Aside from the protection that these areas because the topography is too rugged to make logging profitable and the species of timber are unsuited for exploitation, the recreationist is assured that his interests will be protected by the fact that these areas are under the administration of the U. S. Forest Service, which is definitely committed to a policy of development and protection of recreational areas. Very few of the citizens of the State of Washington are aware that the Forest Service has given this matter due consideration and that it has plans already developed for the proper use of such areas. I am unable to see why there is agitation at this time to protect areas that are already being given proper protection and for which plans have been made that will insure their continual use for that purpose. The Forest Service, through its broad slant on various uses of the forest, is in better shape than any other department to place the proper emphasis upon recreational use, because in this western country, where the major industry is lumbering, there must be a sane balance between land that must be kept for timber production and land that should be dedicated to recreational use.

In taking exception to these views, one might criticize by saying that my viewpoint is only a local one and that the recreational use of our forest lands in western Washington should be considered from a national as well as a local standpoint. Such a criticism would be valid if one took merely a local slant on such an outstanding phenomenon as the Yellowstone National Park or Crater Lake. But the attractions of our western Washington mountains are very similar to those found in the Cascades and Rockies, and the area is so large and is so well protected from commercial exploitation, by

Nature as well as by the established policies of the Forest Service, that this region will always offer to the out-of-state visitor ample areas in which he can enjoy nature in the rough. Therefore I think that the arguments which apply to our local population apply as well to our out-of-state visitors.

The restricting of large areas of productive forest land for limited recreational use will work a real hardship on the people of western Washington by depriving them of forest material necessary to carry on the payrolls of the state; will seriously jeopardize the possibilities of continuous forest management by removing the needed back-log of mature timber; and will add little to the enjoyment of the public, both local or national, in the way of recreational use of our forest lands.

Viable Seed from Nine-Year-Old Southern Pine

IN THE regeneration of idle land, the age at which trees begin to reproduce from seed is of considerable importance. In 1934 a nine-year-old loblolly and shortleaf pine plantation at the Agricultural Experiment Station at Auburn, Alabama, produced a fair cone crop. Some of the cones were collected, the seed extracted, and 100 seeds of each species planted in pots in the greenhouse. Germination counts on successive days from the twenty-first to the thirty-fifth day after planting gave the following results:

Days	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	Total
Loblolly	11	9	10	2	2	3	6	4	0	2	2	1	1	2	0	55
Shortleaf	30	6	2	2	1	0	0	0	1	0	0	1	0	0	0	43

Cones have been noticed this fall (1935) on an adjoining plantation of slash pine of the same age as the loblolly and shortleaf pine.

D. J. Weddell,
Alabama Polytechnic Institute.

WHAT ARE THE LARGEST TREES IN THE WORLD?

By HARRY D. TIEMANN

Forest Products Laboratory, U. S. Forest Service

This authoritative article brings together the results of diligent inquiry pursued over a long period of years to sift the information, and establish the facts regarding trees, all over the world, for which claims of preeminence in height, diameter, bulk or age have been advanced.

INFORMATION on the dimensions of trees which were felled or destroyed long ago is unreliable, and original recorded data of the largest trees have in many cases beeen lost or exist only in memory. Frequently heights were estimated by eye or guessed at. Citations of pre-existing trees from 400 to 500 feet in height are often fabulous; and the tallest living tree of unquestioned and authenticated measurement is a Coast redwood (*Sequoia sempervirens*), 364 feet. The conclusion must be drawn, however,[1] that judging by well established diameters of vanished trees, in comparison with living or known trees, heights of 400 feet might in the past often have been exceeded, especially in the case of the eucalyptus; but no absolute confirmation exists today as in no case are authenticated original measurements available. It is most unfortunate that none of these giant trees were preserved, and that accurate measurements were not established, for no one now living will ever see their equal. Professor Sargent, eminent American authority, stated: "I am of the opinion that, so far as our knowledge goes as present, California is the home both of the tallest and of the broadest trees in the world."

In height the outstanding species of living trees today are the redwoods (*Sequoia gigantea* and *Sequoia sempervirens*), the eucalypts (especially *Eucalyptus regnans*), and the Douglas fir (*Pseudotsuga douglassi*). In basal diameters the Sierra redwoods or bigtrees are preeminent as a class, although certain individual specimens of several other species in other parts of the world exceed them, and in times past they may have been outclassed by the eucalypts.

As to volume, supremacy appears to lie between the bigtree of California and the kauri (*Agathis australis*) of New Zealand.

Tallest Trees

California Redwoods.—The tallest known living redwood is standing on North Dyerville Flat (in the Humboldt State Redwood Park), which authentic measurement by Enoch P. French, superintendent of the Park and a redwood cruiser of long experience, gives as 364 feet high, and 12 feet 7 inches in di-

[1]Heights do not necessarily increase with diameters, but the fact that the stumps of deceased trees persist for many years after their heights are a thing of memory only, coupled with the fact that many of these surviving stumps far exceed those of any living trees, justifies the statement. Moreover, there are so many uncertified and unauthenticated records of height measurements, especially of Australian eucalypts of over 400 feet, that credence may be given to the conclusion, especially so since human beings have as a rule taken special pains to seek and destroy the finest and tallest specimens. It is a strange psychological idiosyncracy that almost invariably the accounts of these superlative living creatures are written by men who seem to have gloried in being instrumental in their destruction.

ameter at 4½ feet above ground.[2] This tree is said to be still growing in height, and has been preserved. On Bull Creek Flat, at the junction of Bull Creek with the South Fork of Eel River, another tree was measured by the same party in December, 1930, as 361 feet high and 14 feet in diameter at breast height; another tree, located 180 feet east of the Redwood Highway between Dyerville bridge and the bluff at the south end of the flat, was measured by the same party as 353 feet, diameter 15 feet breast high; and one on Bull Creek Flat grove of the same state park, formerly the Metropolitan Lumber Company's land, as 347 feet high and 16½ feet diameter breast high (same letter already referred to in footnote). There are many other tall trees in this region in Humboldt County on the Coast.[3] A living bigtree in the Calaveras Grove, now a state park in the Sierra Nevada Mountains, is given as 325 feet in Bulletin 28 of the Division of Forestry, U. S. Department of Agriculture, entitled "A Short Account of the Big Trees of California" (Washington, 1900). The conclusion must be drawn that, even if in the case of trees no longer in existence the heights of eucalypts once exceeded those of the redwoods, which seems highly probable, of *living specimens* the redwoods now excel the eucalypts by some 50 feet.

There is little information concerning heights of non-existent Sequoias. The prostrate trunk of "The Father of the Forest," a bigtree (*S. gigantea*) in the Calaveras Grove, was wrongly estimated as having been over 400 feet tall (Division of Forestry Bulletin 28). The estimate of the traces of the prostrate trunk was subsequently determined to include two trees.[4] Walter Fry states that the tallest tree he has measured is a prostrate trunk in the Redwood Mountain Grove 347 feet long.[5]

Australian Eucalypts.[6, 7]—The tallest eucalypt of authentic measurement was a "mountain ash" (*E. regnans*) at Colac, Victoria, living subsequent to 1888, but since destroyed. This tree measured 347 feet.[8] There is no living eucalyptus tree approaching this height so far as known, although it is probable that trees once existed 400 feet in height. Many statements have been made by various writers, of trees said to have been measured ranging anywhere from 400 to 525 feet in height. Baron Ferdinand von Mueller (formerly Government Botanist of Victoria) himself is reported to have said "the highest known is ascertained to be 480 feet, and therefore as high as the Great Pyramid" (in Gardener's Chronicle for 1862). This statement is, however, ascribed to hearsay and is unsupported by any precise data, according to A. D.

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[2]Measurement made with a transit. Located 650 feet east of junction of the Redwood Highway and the South Fork Station County road. Letter from Enoch P. French of Eureka to Newton B. Drury, Secretary of Save the Redwoods League, 114 Sansom St., San Francisco, January 4, 1931. See also photograph in *American Forestry*, November, 1931. Has recently been named "The Founders Tree," but is already being desecrated by tourists.

[3]Professor Emanuel Fritz states in a letter of May 10, 1934, that "there are several around 360 feet: more around 350, and quite a few 330 to 340 feet."

[4]Wilder, Marshall, Big trees. pp. 25-28. According to Professor Fritz, who has examined the remains, this account by Wilder is much exaggerated.

[5]Fry, Walter, and White, John R. Big trees. Stanford Univ. Press. 1930.

[6]See account, The giant trees of Australia. By J. H. Maiden. Government Botanist, N.S.W., in his Forest flora of New South Wales, Part XVIII. (Vol. 2), pp. 162-163, which gives a very complete abstract of accounts.

[7]Hardy, A. D., Tall trees of Australia. In Victorian Naturalist, July 4, 1918, pp. 46-55. Measuring of tall trees, ibid, April, 1923, pp. 166-175.

[8]Scientific Australian (Melbourne) July 11, 1821, p. 95.

Hardy. This tree was a mountain ash on the Blacks' Spur near Healsville. I myself spent a week-end at the home of an old pioneer of long residence at this place, the late John Lindt, and had anything approaching such height ever existed I am sure he would have known about it. The tallest living specimen in this region at the time of my visit was a magnificent mountain ash, of which I took the accompanying photograph with Mr. Lindt standing at its base. He had accurately measured its height by triangulation and found it to be 263 feet; and this was an exceptional tree. All of these early accounts of trees now extinct have been discredited or proved fabulous, including that of the famed "Big Ben" alleged to have been over 400 feet tall;[9] and "The Baron," a photograph of which was exhibited at the Melbourne Exposition in 1888, and which was alleged to have been 464 feet in height. Later accurate measurement of this latter tree by the government surveyor proved it to be only 219¾ feet high! Hardy quotes a letter from G. Cornthwaite, a licensed surveyor of Colac, Victoria, in which he gives the height of a then (1880) standing mountain ash, 2 miles from Thorpdale, in Gippsland, "by means of clinometer and chain and made it 370 feet. Afterwards when it was chopped down, I measured it 375 feet, allowing for the stump." This sounds very plausible, but unfortunately he adds: "I cannot find the old notes taken at the time, but I am quite sure as to the measurement of the length."[10] Further mention of fabulous sizes of former trees may be dispensed with here, as they are given in the article by Maiden already referred to in footnote 6. In this article he says, "In fact these old records are simply unreliable in spite of their apparent attention to details."

During the Melbourne Exposition in 1888 over £600 was appropriated for measuring and photographing the tallest living trees, and prizes up to £100 were offered for information of any tree 400 feet high or over. None was found approaching this height, but a mountain ash on Mt. Baw Baw in Gippsland, about 90 miles from Melbourne, was discovered, called "The New Turkey Tree," which measured 326 feet. Subsequently a tree was found at Colac which measured 347 feet,[11] according to Owen Jones, formerly Victorian Forestry Commissioner.[12] Both of these trees have since departed. I saw a fallen giant at Sassafras, about 60 miles from Melbourne, the lower portion of whose trunk though hollow was then intact in circumference, but it has since collapsed. This measured 17 feet in diameter above the root swelling, but there is no means of knowing what its height may have been since the upper portion was shattered and long ago decayed.

The blue gum (*E. globulus*) and the stringy bark (*E. obliqua*) formerly reached great size in Tasmania. In the government publication of the Lands Department Crown Land, Laws and Timber Handbook of the Australian Industry, published in 1914, it is stated that these trees often reach a height of 350 feet and a clear barrel of 250 feet to the first limb, and a circumference of over 20 feet, 3 feet from the ground, and that

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[9]See picture in article by A. D. Hardy, Measuring tall trees, in Victorian Naturalist 39; 12, April, 1923. Mr. Hardy writes (1934), "In 1894 I visited 'Big Ben' with Mr. Lindt, the Baron (von Mueller) and Prof. Komat. The latter regarded the tree as approximating 300 feet." Also picture in Victorian Naturalist, March, 1935, article by A. D. Hardy, Australia's great trees.

[10]Concerning the probability of the correctness of these measurements Hardy writes (1934): "I have discussed the question (of fault in memory) with Cornthwaite since. He says the measurement with the newly acquired theodolite made too vivid an impression to be blurred by time."

[11]See U. S. Geographic Magazine, December, 1916, article by H. E. Gregory.

[12]Scientific Australian (Melbourne) July 11, 1921, p. 95.

trees 66 feet in girth are not unknown. Mr. L. G. Irby, formerly Conservator of Forests for Tasmania, in Australian Forestry Journal, September, 1925, gives an example of a blue gum in which the first branch was 208 feet from the ground and the total height 318 feet. There seems to be no reason to doubt these figures. Whether or not any such trees are still standing in Tasmania I have no information, but I have seen some very large ones being lumbered, which leads me to think that there are.

Concerning living eucalyptus trees today, it is seldom that any exceed 300 feet in height. Mr. Hardy and I measured a mountain ash on a steep slope in Sassafras, with clinometer and chain, which proved upon calculation to be close to 300 feet. Hardy states in the Victorian Naturalist, March, 1931, and also in March, 1935, that the tallest living Australian tree is situated a few minutes' walk north of the picnic place at Cumberland Bridge, about nine miles from Marysville (about 50 miles northeast of Melbourne). It is called the Cumberland Tree and is one of a group

Fig. 1.—The author and Mrs. Tiemann on the Black's Spur, Victoria, at the base of a mountain ash (*Eucalyptus regnans*) 263 feet in height.

Fig. 2.—The same tree as Figure 1. Note how the stringy outer bark shreds off part way up, leaving a smooth clear trunk which is of a beautiful pinkish color. The person is the late Mr. John Lindt, an old time pioneer and a fine artist.

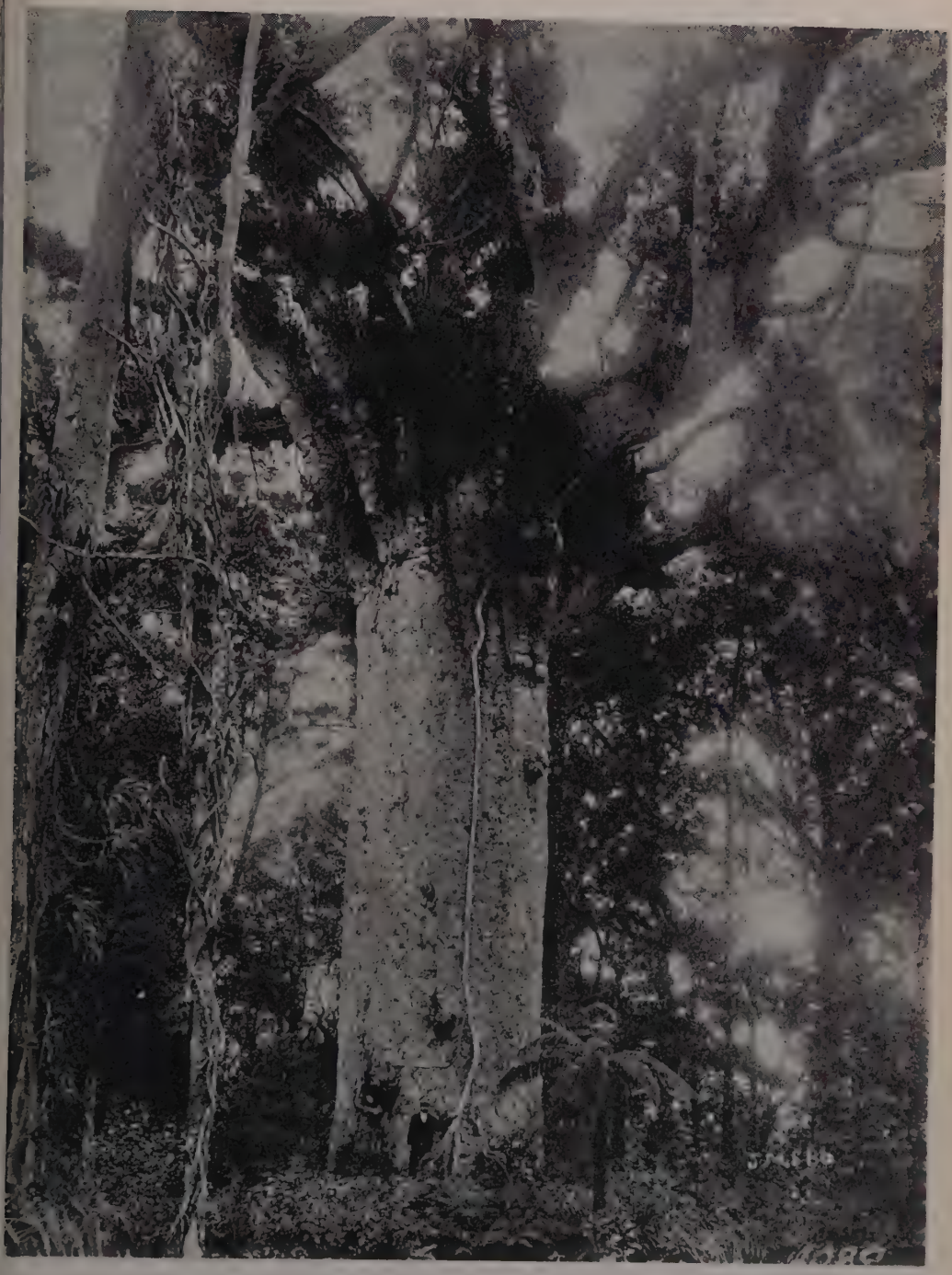

Fig. 3.—New Zealand kauri (*Agathis Australis*) About 16 feet in diameter. (Courtesy New Zealand Forest Service).

of tall eucalypts which the Victorian Forest Commission has recently protected and made accessible to visitors. This Cumberland Tree is 301½ feet high and has a girth of 20½ feet at 5½ feet above the ground and of about 17 feet at 10 feet up. This is a mountain ash (*E. regnans*).

The tallest living tree in western Australia, as measured by Lane-Poole on the Upper Donelly River, by means of an Abney level, is 278 feet, a giant karri (*E. diversicolor*).

Perhaps the most magnificent example of living trees is one standing near Mt. Monda which was named by Hardy in 1902 "The Mueller Tree," but was recently "rediscovered" by Furmston. This Mueller Tree stands on steeply sloping ground and measures 63 feet in girth 3 feet above the ground on the higher side. Its height is 287 feet to a broken top, and it must at one time have exceeded 300 feet. It has a splendid tapering and buttressed base and is indeed an imposing tree, comparable with some of our largest sequoias. An excellent photograph of the lower portion of this tree was made by the Railways Department, and is reproduced in *The Victorian Naturalist*, March, 1935, in the article by A. D. Hardy, already referred to, on Australia's great trees.

As the optimum growth of these trees coincides with the civilized inhabited regions in Australia, likelihood now of finding some as yet undiscovered tree is small.

Douglas Firs.—Contrary to common opinion, next to these recently destroyed eucalypts, the Douglas fir seems in times past to have held supremacy as to height. A giant Douglas which grew in the Seymour Valley at Vancouver, B. C., was felled by George Carey in 1895. I have investigated the basis of this information and am convinced that the data is well substantiated from a number of different sources, although it has been much questioned. The available information gives the height as 417 feet; diameter at the butt 25 feet (this diameter is substantiated by a photograph of the felled butt in which there are a number of people); thickness of bark, 16 inches. At a height of 207 feet the diameter was 9 feet. The trunk was free from limbs for a height of 300 feet! This was a remarkable tree if the information is correct, and it establishes the Douglas fir in former times as one of the tallest trees in the world![13]

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[13]Unfortunately direct information about this tree has been peculiarly difficult to obtain. Mr. Carey, who felled the tree, and who was apparently a long time resident of Vancouver, from whom the data was obtained, is no longer living, and a Mr. Mullett, formerly a scaler in the British Columbia Forestry Service, who was present at the felling, cannot be located. The alleged photograph of the stump was published in the British Columbia Lumberman, March, 1927.

Mr. H. Steere-Clark, Safety Director of the B. C. Loggers Association, in a letter to Mr. Newton B. Drury dated June 17, 1931, after quoting the dimensions stated above, continues: "These dimensions are in no way exaggerated, but were taken by the head feller and his crew at the time of felling. Mr. Carey, who actually felled the tree, has been dead for some years, but the record left behind him is authentic." And in a letter to me of March 3, 1931, he says: "This is also confirmed by Mr. O. Mullett, who was employed in the Forest Service at that time, as a scaler.—The photograph which I exhibited at the National Safety Congress would not actually give the true perspective as to the size of the butt, owing to the position from which the picture was taken, but that it was actually 25 feet through is confirmed by several residents of that district.—I am very sure that the statement that I made is based on fact, for this particular tree was quite historical in the annals of British Columbia logging.—The statement made by the B. C. Lumberman was obtained from the same source as my own."

Mr. R. M. Essie, Editor of the British Columbia Lumberman, writes (Sept. 30, 1930): "At the time this picture was given to me I also was very doubtful as to its authenticity, but Mr. O. L. Mullett, late of the B. C. Forest Service, who lent me the picture, assured me that the photograph was absolutely genuine, and that he had heard several people talking about this

From near this region, at Gordon Pasha Lake, three flag poles were cut of unusual dimensions. One is now located at Kew Gardens, England, and is 217 feet tall, another at the Court House, Vancouver, 212 feet, and the third at the University of British Columbia, not yet erected, 204 feet.

Mr. E. T. Allen affirms having measured with a steel tape a Douglas fir felled in 1900 which scaled 380 feet in length. Neither this figure nor the location of the tree can now be positively authenticated, however.

The Long Bell Lumber Company reports a Douglas fir 324 feet 4 inches tall, and 37 feet in circumference, at Ryderwood.

Basal Diameters

The bigtree (*Sequoia gigantea*) of the Sierra Nevada Mountains outstrip the Costal Redwoods (*S. sempervirens*) in bulk and in diameter, but not now in height, and probably never so, since the form of trunk is inclined to be more tapering, with greater root swelling. Basal diameters of different trees are often very misleading on account of the root swelling and the buttressing of the trunk and the slope of the ground. Comparative data must always be interpreted with this precaution. Figures quoted for the bigtrees in this regard are particularly misleading since the diameter is generally stated at the ground level or where the root swelling is very pronounced. Even up to 20 feet above the ground the diameter is generally strongly influenced by the swelling.

This is evident by the following accurate measurements made recently by a party of engineers by engineering methods[14] on the "General Sherman" in the Sequoia National Park, establishing it as the largest by volume of living sequoias, and also on the "General Grant" of a nearby grove, which is the next in size, and two others of smaller dimensions. The mean diameters outside the bark of the restored form of these two largest trees is as follows, in feet:

	Gen. Sherman	Gen. Grant
Ground level	30.7	33.3
10 feet above	24.0	24.0
20 feet above	19.8	20.0
60 feet above	17.5	16.3
120 feet above	17.0	15.0

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wonder tree." In a letter from G. M. Eveleigh of the Architectural Institute of British Columbia (April 16, 1931) he says: "Now there was only one George Carey in Vancouver at that date and I lived in his house for about 2 years. I know him well and always have a chat when he is in town, he is away most of the time nowadays in Alaska with his son or in the South. —I admit I had never heard of this tree and am inclined to think it must be a cedar." In another letter from Mr. R. M. Essie to Mr. Donald Bruce, dated Oct. 23, 1930, he says: "There is not the slightest doubt that the tree was felled in the vicinity of Vancouver. Several of the people in the picture can be identified as residents of this district." And finally, in a letter to Prof. Emanuel Fritz, Mr. Essie, November 19, 1934, states: "Some years ago the picture was brought to us (with the dimensions) by a member of the Forest Service of B. C. (Mr. Mullett). We cannot vouch for the measurements of the log, but as you will see from the picture it is an exceptionally large one. The only clue we have of the size of the tree is the evidence of Mr. M. Lavell, since deceased, who in a letter dated February 24, 1926, states that he was one of the people who were taken in the picture and that the tree was felled in the Lynn Creek Valley on the north shore of Barrard Inlet, Vancouver. I have no reason to doubt the statement of Mr. Mullett regarding the size of this tree, but we have no actual signed affidavit or anything like that concerning the matter."

The evidence of the letter from Mr. Lavell is important, since if true it establishes the photograph as authentic and not that of a California redwood as some have inferred. And if the photograph is really that of the butt of a Douglas fir, there seems no reason to doubt the dimensions given, for it was indeed a huge tree, larger than any now living. Other correspondence fails to bring any further evidence to light.

[14]Engineering News-Record, Feb. 18, 1932; article by J. W. Jourdan.

The greatest authentic recorded girth of eucalypts in Australia is that of a mountain ash (*E. regnans*) alive in 1918, but now dead, near Marysville, Victoria, named "King Edward VII," which was 25½ feet in diameter 10 feet from the ground,[15] but the buttressing is still pronounced at this height. At the ground the girth is given as 112 feet, diameter 35.6 feet. It is impossible therefore to say which trees have the largest basal diameters.

Other diameters of some of the largest living bigtrees in the Maraposa Grove at ground level and at 6 feet above (but dimensions at 10 feet are not recorded) are given in Division of Forestry Bulletin 28 as follows:

Ground level	29.5	29 2	26.0	26.0	26.01	23.1	20.7
6 feet above			21.4	18.8	15.9	17.5	16.2

As to former trees long dead there is a fallen bigtree called "Father of the Forest" in the Calaveras Grove, already mentioned, stated as having a circumference *at the ground* of 110 feet (35 feet in diameter), and at 10 feet above, 20 feet 8 inches. As already stated, its supposed length of 400 feet was found to be spurious, and the alleged diameter figures are questionable. One of the very best and most comprehensive accounts of the bigtrees is given by John Muir in his "The Yosemite." In this account he describes a badly fire scarred tree in the Kings River forest as 35 feet in diameter inside the bark four feet above the ground. By carefully cutting away the burned portion he was able to count the rings clear to the center and found them over four thousand![16] This was the largest and oldest sequoia so far as authentic information is available. Whether or not this fire scarred veteran is still standing, I have no knowledge. It has not been relocated, although it has been searched for. Another bigtree in the Calaveras Grove, felled in 1853, was 25 feet in diameter inside the bark 6 feet above ground, the bark being 15 to 18 inches thick. Forty-nine people danced on the stump! So Nero fiddled at the burning of Rome.[17]

Fig. 4.—"Castagno dei Cento Cavalli" on the slope of Mt. Etna, Sicily. The three parts were united in a single trunk within memory of living inhabitants. This is the Spanish or Eurasian chestnut, *Castanea sativa*. (Courtesy of Director of Agricultural Experiment Station, Rome).

From these figures it would seem that the eucalypts may have been superior to sequoias in basal diameters, but it is difficult to make comparisons on account of differences in the buttressing of the trunks, often induced by the healing over of fire scars.

However great the sequoias and eucalypts, it appears that they must nevertheless take a back seat when compared with certain individual trees of other species as to diameter.

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[15]Photograph in official Handbook of Victoria, 1914, p. 315.

[16]Muir, John. The Yosemite. Century Co. 1912. p. 129.

[17]Professor Fritz states in a letter that he has a transcript of the rings made on the stump in 1865, which shows only 1245 rings. A newspaper called "*The Big Tree Bulletin*," was printed on the stump in 1858, and a bowling alley built on the prostrate trunk!

The famous chestnut tree (*Castanea sativa*) at the foot of Mt. Aetna, called "Castagno dei Cento Cavalli," exceeded all recorded measurements in trunk circumference.[18] It is still living and growing vigorously, but has now become broken into three separate but vigorous pieces, which are fire scarred. It is stated by local inhabitants that about 70 years ago it was united in one trunk. Various figures are given as to its former size. In the Encyclopaedia Brittanica, it is stated that when measured by Count Borch in 1780 its circumference was 190 feet. The Chambers Encyclopaedia gives 204 feet (in 1836). Present accounts state that the individual pieces are colossal and the over-all circumference 174 to 190 feet. The accompanying photographs of this astonishing tree were furnished by the courtesy of The Director, Agricultural Experiment Station, Rome, supplied by "Foto Marino" of Sicily. While this tree may have been a number of sprouts grown into one, it is stated that investigation made over 100 years ago showed that all originated from one root. The tree is of exceptional age, estimates giving it as 4,000 years. There are many other huge chestnuts in this region.

Another famous chestnut was at Tortworth, Gloucestershire, England, known as a boundary mark in the reign of King John and supposed to have been 500 years old at that time. It was alive and bearing fruit in 1838, and its trunk is given as 15 feet in diameter at that time, its age being then 1,100 years. I have no recent information concerning this tree.

Of course such trees are not to be compared with the stately redwoods or the eucalypts on account of symmetry of proportions, but they indicate the remarkable vitality of the European chestnut.

A plane tree (sycamore) of Bujukders on the Bosphorus is stated by Knight and Steppe to be 50 feet in diameter. The great cypress (*Taxodium mucronatum*) of Santa Maria del Tule, Oaxaca, Mexico, has a diameter at the ground of 40 feet. At 5 feet above ground it is 35 feet, girth 108 feet. Its height is 141 feet.[19]

The largest authentic kauri tree in New Zealand, at Mercury Bay (now destroyed), measured 24 feet in diameter,[20] with a clear length of 80 feet. One tree at Tu-ta-moe Forest was called "Kairaru" by the native Maoris and measured 22 feet in diameter and 100 feet to the first branch (Percey Smith, Surveyor-General, in 1874). Another of the same diameter in this same forest was called "Ngamahangahua," but this one forked at a height of 22 feet. As there is no root swelling in these trees and the trunks are very round and somewhat column shaped (kauri has a form factor of 1.00!)[21] this diameter measurement is more significant than in the case of buttressed trunks or those with root swelling. The same is true to a less extent of the jaquitibá trees in Brazil, which measure up to 23 feet in diameter and 150 feet in height.[22] Although the kauri have huge trunks and great clear lengths, they are not relatively so high as the sequoias and eucalypts on account of their "feather duster" shaped crowns. Hutchins estimates the maximum height in the past

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[18]Account by Prof. Montemartini, The oldest trees in Italy, and photograph in Le Vie d'Italia; rivista mensile del Touring Club Italiano. Feb., 1925, p. 130.

[19]Missouri Botanical Garden Bull.: 12, Dec., 1916, and American Forests, Feb., 1935.

[20]Hutchins, D. E., Kauri, the largest timber yielding tree in the world. New Zealand forestry (official bull. of Dept. of Forestry) 1919. p. 42. Also New Zealand Forestry Jour., Feb., 1923.

[21]New Zealand Forestry, p. 48.

[22]Les Bois Indigenes de Sao Paulo. Official bull. de Andrade, Navarro. Sao Paulo. 1916.

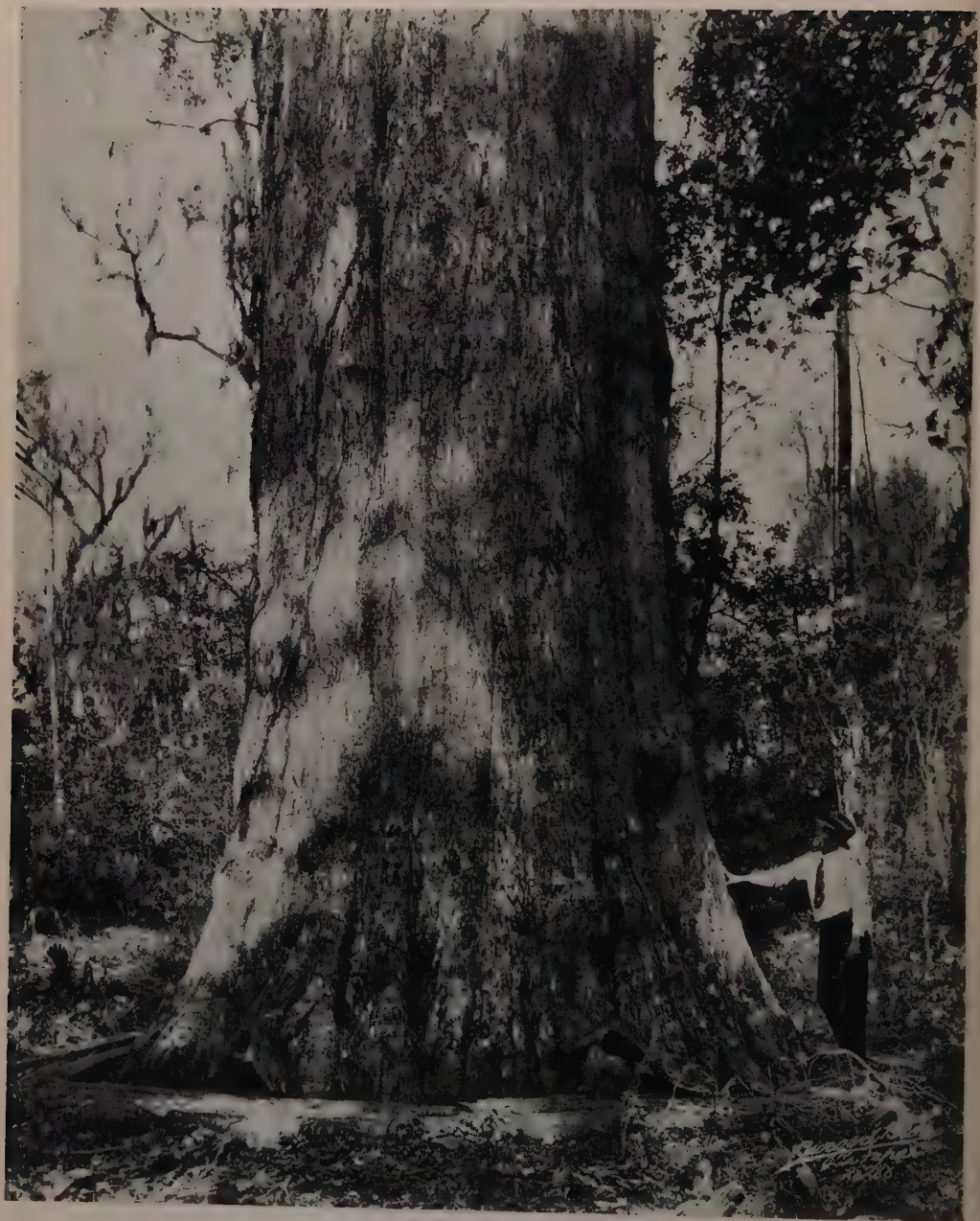

Fig. 5.—California does not contain all the large trees. In fact this one is in Florida; and it is a bald cypress! It is 126.3 feet tall, and measures 42.9 feet in girth 18 inches above the ground, about 11 feet in diameter breast high, and 25.5 feet girth at a height of 62 feet. (Courtesy Southern Lumberman).

as 275 feet, but I think this is an overestimate and 200 feet appears to be the highest measured (Tran. N.Z. Inst. 1868).

The Dragon Tree (*Dracaena drago*) of Orotavia, which grew near the summit of Teneriffe but was destroyed in a storm in 1868, had a diameter as stated by Humboldt in 1799 of over 16 feet several feet above the roots, and of 12 feet at a height of 10 feet above the ground. This tree was estimated to have been 6,000 years old![23] This is a tree of the lily family, related to our yuccas of the Southwest, so that it must have been a truly stupendous tree of this type.

The African baobabs (*Adansonia*) run up to 34 feet in diameter but they have a bloated form of trunk which is relatively very short.[24] The banyans (*Ficus religiosa* and *indica*) have many trunks and therefore spread over an immense area like a forest. One tree on the Narbudda River, Western India, measures 2,000 feet in circumference of its manifold trunks, of which there are 350 large and 300 small ones. A famous banyan in the Calcutta botanical gardens has a main trunk which is 50 feet in circumference, and 200 manifold trunks.

Brazil furnishes some outstanding examples. Some trees of the Monkey Pot Family, to which the familiar Brazil nut belongs, are of remarkable size. *Cariniana excelsa* (= *couratari estrellensis*) known colloquially as Jaquitibá vermelho, reaches 72 feet in circumference and a height of over 150 feet according to de Andrade. As the trunk is columnar without much root swelling, topped with a widely spreading crown, this tree is well called "The King of the Brazilian Forest."

Volumes Are Not Strictly Comparable

It is difficult to say what trees have the largest volume, as volume is measured in so many ways. The kauri trees of New Zealand are among the largest, however. The former "Kairaru" at Tuta-moe Forest, 22 feet in diameter and 100 feet to the first branch, is said to have scaled 221,800 board feet by British quarter girth rule, or 313,000 by an American log rule. This famous kauri tree was estimated by Hutchins[25] to contain 31,416 cubic feet inside the bark and *below the branches.* Another one at Waihow, Hokiango, (presumably living) is said to be 66 feet in circumference, with a clear bole of 75 feet, and to scale (quarter girth) 195,000 board feet. The General Sherman bigtree in California, already discussed, is given by the survey as having a *restored* volume *including the bark and the top,* but not the branches, of 50,010 cubic feet; and the General Grant as 45,232. It is impossible to convert this into board feet accurately since the two methods of scaling are incommensurable, but it might be taken roughly as 250,000 for General Sherman by way of comparison with the others, although these large bigtrees are not as a rule converted into lumber.

Recently a redwood tree was found in Big Lagoon tract on Maple Creek, Humboldt County, Calif., which scaled by the Spaulding rule, by careful measurement, as in 14 logs from 12 to 17 feet in length, 361,366 feet of merchantable lumber (the cubical column of the tree is not stated), enough to build 22 average houses.[26] It

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[23]Singleton, Esther. The greatest natural wonders of the world. Christian Herald Press, 1906. Picture in Strassburger's Text Book of Botany.

[24]See photograph of a baobab in Rhodesia 77 feet in girth, Nat. Geog. Mag., June, 1935.

[25]New Zealand Forestry, p. 49.

[26]Circular by Little River Redwood Company, now the Hammond and Little River Redwood Company, Samoa, Calif., Aug. 27, 1926.

is 20 feet in diameter 5 feet above the ground, and 308 feet high. The Australian eucalypts, although they have very great clear length, are usually slim, seldom exceeding 8 or possibly 12 feet in diameter. The Cumberland Tree is 301½ feet tall, is but 6½ feet in diameter 5 feet above the ground; although some greatly buttressed trees with large root swelling, as the "Mueller" tree, are more tapering. Volume measurements on these are lacking.

When discussing relative bigness of trees, the weights of the wood should be taken into consideration. The weight of the eucalypts is far greater than that of the redwood or kauri. In the air-dry condition (12 per cent), mountain ash (*E. regnans*) weighs about 41 pounds per cubic foot, redwood about 26 pounds, and kauri 34 pounds. When green, mountain ash weighs about 63 and redwood 42 pounds. Thus a eucalyptus log of the same size as redwood might weigh about twice as much, allowing for differences in bark thickness, except for the butt-logs of redwood which sometimes sink in water.

From a scientific viewpoint the question of what really controls the size of trees is perhaps of greater import than information on the accidental size of individual specimens. A plant, unlike an animal, appears to have unlimited growth possibilities. The cells are continuously self-renewing. Why then should a tree stop growing? To say that it reaches a balance between the powers of destruction and powers of growth is entirely inadequate as an explanation. If that were all, then occasional specimens would reach unlimited size. As to height growth, Dixon's cohesion theory of sap ascent, the "saügkraft" of Molz, Ursprung, Blum, Renner and others, seems to offer a possible explanation as pointed out by Professor Ewart of Melbourne University[27] that upward growth must cease when the osmotic pull of the leaves is balanced by the gravitation of the water films and their resistance to flow.

An osmotic leaf pull of 9½ atmospheres is sufficient to raise the sap to over 300 feet, and much higher osmotic suctions have been measured in leaf parenchyma. Furthermore the fact that procumbent forms, such as lianas, grow to even greater length, rotang reaching 590 feet in length (Kerner and Oliver, Natural History of Plants p. 362) lends weight to the hypothesis. But one may well ask, what of it? What difference does it make, since there is little one can do to change the natural order of things in this respect, and trees have been accomplishing the miracle of sap raising for millenniums before man appeared upon the scene. Chiefly this thought: What right has man to glory in the destruction of something he neither understands nor can replace? When a venerable tree, which has withstood the natural vicissitudes of milleniums, meets sudden destruction at the hand of man, is there any occasion for boasting? Rather is it a tragedy of the ages!

Age

What is perhaps the most interesting and indeed the most fascinating thing about these marvels of the vegetable kingdom is their great age. To think of a plant still living, which began its existence in the dim ages of the past, perhaps when the Pharaohs were building the Pyramids and human civilization was young, having survived through all the changes and vicissitudes which have occurred through written history, grips the imagination. Unfortunately there is no way of knowing the age of a tree.

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[27]Ewart, A. J. Ascent of water in trees. Trans. Royal Soc. 1908.

Anton Kerner (Kerner and Oliver, Natural History of Plants) has this to say as to age:

"The records of age which have come down to us are for the most part too great. The celebrated Baobab was reckoned by Adanson to be about 5,000 years old, but whether a miscalculation has not crept in must remain uncertain. The age of the celebrated Dragon Tree of Orotavia has been estimated at 6,000 years; The Plane of Bujukdere, on the Bosphorus, at 4,000; and the so-called Mexican Cedar was estimated by Humboldt at 4,000 years. I would not like to stand security for these numbers. On the other hand the following extreme limits of age are calculated with fair accuracy: cypress, 3,000; yew, 3,000; chestnut, 2,000; oak, 2,000; cedar of Lebanon, 2,000 years." He does not mention, however, the Chestnut of One Hundred Horses, nor the California sequoia.

Even could one obtain an unbroken radial strip clear to the heart, ring growth would be lacking or meaningless in many trees in tropical regions. Comparative rates of growth are also useless in such estimates. The redwoods can be estimated, at least within reason, by their rings. The oldest so estimated of which I am aware is the one already referred to, described by John Muir, as being over 4,000 years. It is easy to imagine that the cypress at Santa Maria del Tule is considerably older than this. The Dragon Tree is naturally a slow grower, but all that can be said is that possibly it may have been 6,000 years old. The Chestnut of One Hundred Horses must indeed have been of very great age, but how old no one will ever know.

Grateful acknowledgment for assistance in collection of data is due especially to Mr. A. D. Hardy, botanist of the Victorian Forest Commission, and to Prof. Emanuel Fritz of the Division of Forestry, University of California.

AUSTIN CARY SPEAKS OUT

The correspondence which follows explains itself. The JOURNAL OF FORESTRY has received it as a contribution from Dr. Austin Cary, whose retirement from the federal Forest Service was noted in the September issue. In the form of a letter to the President of the United States, the author here brings to bear on the question of the respective fields of public and private forestry, the convictions resulting from a lifetime of close-range observation and realistic thinking. The distinction and individuality of the form of expression are matched by the vigorous sincerity with which a profound believer in private initiative and sagacity stands by his colors.

UNDER date of September 5, 1935, Austin Cary addressed the following letter to Secretary of Agriculture Henry C. Wallace:

"This and the enclosure are sent you not only because of your official position and concern with the subject matter but because what you say and do conveys the impression of a sincere and earnest man. Then a special circumstance seems worthy of mention by way of introduction—the fact that on the 13th of August last you signed a letter to me appreciative of 25 years' activity in the National Forest Service from which I was retired a couple of weeks before.

"The enclosure, you will observe, is in the form of a letter to President Roosevelt. It was written about 17 months ago, in Florida where I was then stationed. For a year and more public affairs in the field of Forestry had not been moving in ways that appealed to me and at the time mentioned I was particularly disturbed in mind. Sitting down to put my ideas on paper, I found this form the one in which I could write most forcibly.

"The paper has never to my knowledge gone higher in government circles than the Bureau. It was put on file there and has been read by numbers of men in the organization; also it has been seen by a number of informed, interested and discreet men outside. A good share of these men have expressed hearty commendation of what it contains.

"That, I think, is sufficient by way of introduction. Should you read what I have written attentively, you will realize, I am sure, that a feeling of serious concern and responsibility prompts this action on my part."

The enclosure referred to follows:

LETTER TO PRESIDENT ROOSEVELT WRITTEN AT LAKE CITY, FLA., APRIL, 1934

BY AUSTIN CARY

I leave others to vouch for me in a general way, but several circumstances that connect my career with your own I desire myself to mention. I am in the first place a lifelong conservationist, in point of years in fact the oldest forester in the country; my native state, Maine, is not so far away or different from your own; for a year in the Governorship of Mr. Hughes I was Superintendent of Forests in New York; finally during the past 17 years, as a member of the National Forest Service, I have worked much and secured a wide acquaintance in the state of Georgia. These circumstances, it is thought, will add reality to what I write and perhaps explain and excuse to an extent the length of this communication. It bears on features of forest policy for the country.

The forest history of my own state presents aspects that I believe highly significant. The falls of the Piscataqua River in Maine dispute with Manhattan Island and Jamestown in Virginia the distinction of being the site of the first sawmill erected in the United States; 1630 is the date for Maine. It is, of course, known to you that lumbering for very long was Maine's leading industry, that at one time Bangor shipped more lumber than any

other port in the world. New York and Pennsylvania came into large production later; later still the Lake States and South, and along 50 years ago the lumber manufacturing industry of Maine began to shrink;—not, however, from exhaustion of resources as might be thought and had often been predicted, but under force of competition chiefly. Lumber manufacture was, however, promptly replaced by paper making, again in competition with New York. For several decades Maine has produced more of that commodity than any other state in the Union; during the last four decades a greater volume of wood material has been taken from her forests than ever in the same length of time before. Local forest industry, however, is by no means ended. In fact, Maine foresters and business men, on the basis of history and careful surveys alike, believe that Maine's forests are today growing more wood than has been removed from them in very recent years,—as far as pulpwood is concerned very nearly as much yearly as was ever yearly removed.

This line of statements is of course opposed to ideas about American forests that are most frequently expressed, and I do not mean to imply that other sections of the country have followed a similar history. Some have approximately; some not at all; qualification would take too long. It is, however, essential to my purpose to trace briefly the relation of "Forestry" as the term has been used of late years, to the history of this timber state.

In 1892 very few Maine people indeed knew there was such a word or thing. They were, however, a prudent and thrifty people, and in their own way understood their woods. And forestry in the new sense as brought to them did not shock or antagonize. No technical or theoretical ideal, but the actual well being of our people was its aim and motive, and it took them on grounds already perfectly familiar, of prosperity, economy, and prudence. Good feeling and common counsel resulted accordingly, and these conditions, we ourselves feel, have led to satisfactory results. To specify, in the middle 90's large-scale forest fire protection began to be organized; it has gained steadily in effectiveness since. Maine recognized always in this field as one of the leading states; a noteworthy feature of the system is that land owners chiefly support it financially, not the local public. Taxation is recognized as presenting especial difficulty in connection with forest property. In the year 1908, after strong agitation and thorough debate, an adjustment of this matter was effected in Maine, somewhat along lines advocated today, that has served us well and remained undisturbed since. Our actual timber business, too, though characteristically cautious on the financial side, we feel has been reasonably open-minded in respect to the silvicultural side of things also. Right today amongst us we have in mind measures for increasing production in our forests that I am sure will be applied on a large scale as soon as there is economic warrant for so doing. The whole of what I have been saying may be summed up in the following:—in this particular state forestry and the timber industries are and long have been pretty nearly one thing.

Next I plan to make some reference to your own state of New York, and the connection will best be made if I state that many years ago, 80 to 100 and more, Maine sold to private owners the timber lands taken over from Massachusetts when the state was formed. The prices seem ridiculous today, but present times are not a fair standard. A main point is that with this measure poaching on public property and political influence in its operation ceased. Thenceforward timber land was private property, respected, easily defended under the law. The sequences in various directions I have recounted already.

New York on the other hand was slower in disposing of her land, and 50 years

ago still retained large areas in the Adirondack and Catskill Mountains. Its history of course you know—how after long plundering, by way of moral revolt and following the ideas of certain classes of people, a constitutional amendment was passed providing that those lands should remain forever wild forest and the timber thereon neither be cut nor destroyed. So it has gone since, as with large areas added by purchase, the timber rotting down as it matures. When I was superintendent, a lumberman could not cut a road across state property to get his timber out; we tried to locate and prosecute tourists who might cut tentpoles and fuel; some residents within the Forest Preserve had to go many miles for their winter's firewood.

That for a first point. The second is this—that with the idea of soil protection and equalization of run-off, New York has on several occasions condemned and paid for, at commercial value of the pulpwood standing upon them, considerable tracts of mountain forest. About that I will only remark further that we in Maine and New Hampshire who cut our mountain timber when we came to it do not know that in these other ways we have fared less well.

These measures to an extent have starved industry. That was finally recognized in your state and the condition met in ways which you know well — a $20,000,000 bond issue sanctioned to buy old farm and other lands outside the Forest Preserve, plant them up, and otherwise manage them intensively at large expense in order to provide timber for industrial uses.

I am very sure that no error as to fact will be found in the above. Ideas naturally will vary, and in as complicated a matter should be expressed with caution. All I care to say in that way is that I feel very sure I represent the feeling of the northern New England states in being thankful that our own timber history has followed no such course, and in hating to think of the possibility that national timber affairs may be dealt with on such lavish principles.

Another set of circumstances connected with Maine I wish to develop. Working in the state in the summer of 1933, as has been my custom, late in August I learned accidentally that Governor Brann was interesting himself in the project of a National Forest. That interested me; I tried to get better informed, but for long failed to do so. This I found—that nothing was known of the matter by our big land-owning paper companies, whom we Maine people look on as making up our most valuable single industry and as our best conservationists as well. Nor did any other publicity on the topic follow, as far as I saw. As to what may have been underneath, this came out about October 1;—one of our paper mill men told, apparently as a matter of friendly warning, that at a special session of the legislature expected to be called at an early date to deal with a number of matters not only was a National Forest to be sanctioned, but laws passed restricting the timber owner's use of his own property. It may or may not be known to you what the final outcome was. Permission for national purchase was voted by a small margin after sharp contest, but with stipulations that rendered it unsatisfactory to the government. Up to last year, let me say, I never heard any hospitality expressed in Maine, but on the contrary much opposition, to the idea of a National Forest.

Now this matter, the part played in it by one and another agency, is not fully understood. No comment will be made therefore except this—that the circumstances recounted have created a watchful and guarded attitude in the minds of a people who considered their conservation record good and who sympathize as fully as any with sound and progressive measures.

Just at this time the matter of forest

conservation and policies related thereto is boiling among us. As central as anything to this condition is an extremely lengthy publication of the Forest Service that was put out two years ago. In the preparation of this, I may say, I had no part. And with many of its findings, I will say also, I disagree or am out of sympathy. I will be specific on some main points.

Sufficiency of timber and timber growth for the country's needs will be the first. We have had experience of these summaries and predictions for many years—first, I think, with the census of 1880. Around 30 years ago, soon after the establishment of a National Forest Service, more or less similar publications followed. In 1920 came the last previous wholesale production of this nature, again by the government. The exact statements made on these various occasions it is not necessary to introduce. It is common knowledge that dire predictions made have by no means been realized, and that apparently for the following reasons:—the problem was too big to be handled statistically in trustworthy fashion; training and bias of the men doing the work of necessity figured largely; unexpected economic trends in timber use entered as time passed, importantly changing elements in the computation; the element of timber growth was entirely neglected in some cases, seriously underestimated, as it seems, in others. As already indicated, since first contact with it I have been thoroughly distrustful of this figuring. An illustration will reinforce the point.

In 1920 the Capper Report, so-called, of the Forest Service summarized the state of affairs in this particular region, of the production of naval stores, in a way that clearly indicated the exhaustion of available timber at just about the present date. Certain business concerns, taking this at its face, acted in accordance therewith, one great concern starting manufacture of the same products from resinous dead wood, the paint and varnish industry setting chemists to work to find substitutes. What, however, has been the outcome? In the time that has elapsed the naval stores industry has produced some of the largest crops in its history; the government is today urging and helping it to control production; its well informed members are apprehensive of a surplus of timber arising in from one to two decades, expecting in fact the appearance of several times the amount it can possibly use unless it expands its markets. Special circumstances are involved here that will be clearer later; I do not mean to imply that the instance is typical. The unreliability of figures of this kind is, however, strongly illustrated.

The Copeland report of 1933 is much more elaborate and impressive. It was, however, produced by much the same men, the same bias and one-sided training. Inevitably much of its material is estimate or guesswork. One fact entitled to tremendous weight in final conclusions to be drawn is given scant emphasis—the fact that in three decades from about 1900 to 1930, due to substitutions for wood and changes in the habits of our people. total yearly drain on the forests of the United States shrank by just about half. This line must, however, be cut off. I will conclude by saying that numbers of informed and interested men I know are of the same mind as myself in thinking that while conservation of resources and improvement of natural conditions are truly matters of great importance at which we should persistently work, the urgency is not so great but that we can take time to go about it economically and in order.

A second line of consideration is of utmost importance and apparently in a way to be largely determined at just this time—the matter of public or private ownership and management of forest. The report referred to asserts that private ownership has failed already, is the cause

of bad conditions represented, and asks for very extensive acquisition by the public.

To this idea in the first place simple economic considerations apply. Then it is clear to my own mind that the facts of the case have not been represented in true and balanced fashion. For instance, a "new public domain" is much bruited today, land reverted to public control following default of taxes. In the southern section of the country it appears as prominently as anywhere, and I am somewhat familiar with the detailed facts here.

This is noteworthy first—that in some states it hardly appears at all—Georgia and Alabama instances. These are relatively conservative states. In parts of Florida, on the other hand, there are, it is true, great areas of tax delinquent and neglected land. To the best of my rather accurate information, following is the true explanation:—poor natural quality for one thing, and in part quality such that, after the native timber has been removed, productive power either for crops, timber, or grass, in the abundance of other land available, does not attract continued ownership. But unreasonable taxation is another and more potent cause. Poor communities, of low productive capacity as a whole, may nevertheless be as desirous of elaborate school buildings and hard roads as those of another sort. Irresponsible suffrage voted for these; bond houses stood ready to mediate with a careless public; the obligations thoughtlessly taken on involved an increasing tax, a tax that has frequently called for the total income-producing power of property. Collapse has followed inevitably. I am able, however, and glad to say that the natural working out of events, though accompanied by heavy loss to some, seems at this time to have forced reform and improvement of conditions which it seems reasonable to hope may never again occur. All that, however, is only collateral to the matter directly in hand. The pertinent inference to be drawn to my thinking is this—that failure of private ownership of uncultivated land has not been demonstrated by this course of events, but on the other hand failure of sense and honesty on the part of the public.

That this view of the case is sound seems to be confirmed by coming at the matter from the other end, and noting that probably the most enthusiastic timber growers in the United States are to be found in this same state and in neighboring Georgia, in sections where conditions as respects taxation are different. Here I touch on a matter that, as attached to the state last mentioned, must certainly be of great interest to you and that, as illuminating strongly the matter in hand, I seem under obligation to recount briefly.

Fifteen years ago the naval stores industry of the southeastern states looked on itself, as did the Government, as a destructive and failing industry. At that time, however, stimulating agencies backed by simple but reliable field observation began to work — agencies which have persisted. The results it is hard to realize or portray. Learning that, instead of the very long periods of time taken by the native timber in maturing its crop, timber suitable for the purposes of their industry might be grown in around 20 years, men have seen opportunity in the fact, and hundreds of them, small and large, today own considerable areas of land which they are handling appropriately for the purpose in mind—protecting from fire, thinning young growth, planting extensively. The naval stores industry of southwestern France, run as private business, has been held up to the world as a model. I see no reason to question why as good or better is not working out here. I repeat that this movement is native and spontaneous. Facts bearing on its adequacy from the public standpoint have been cited already.

This sort of thing, as I have always understood, is an illustration of what we want—spontaneous, natural to America. Citing one marked instance, I claim no more for it than what it is; it is not, however, an isolated instance. This great southern territory is a region that from the forest standpoint is unique, but only within a decade has it begun to realize its advantages. With that, appropriate action has followed to a large extent. Fire protection has been extending fast, and so has interest in forest land as property. Illustrating in this last direction, I will take five large lumbering concerns, mostly in the state of Alabama, that started out in timber raising some 10 years ago and that I myself visited recently. Not one since my last contact, even in these depressed years, had yielded an inch. Stockholders and managers are satisfied; loggers and land men are interested; some had gone ahead of all expectations entertained for them. Through such agencies (and given opportunity and encouragement I am satisfied they will gain greatly in aggregate force) I see working out permanence of industry, sustained yield to a degree, the various benefits we have attached to maintained forest—and all that on the strict economic lines that characterize private business. Again I will throw in a qualifying idea, saying that I am writing of the south primarily. Somewhat different conditions prevail in the Lake States and far west; with these I am not dealing.

This communication, I feel, should be brought to a close. I will begin to do that with a few general observations.

Many times of late years, as I have looked back over the more than 40 years in which I have played a part in the forestry movement of this country, a feeling of gratitude, of appreciation for the open-mindedness and response of my countrymen to sound and progressive ideas presented to them, has possessed me. To be sure, that was not universal or perfect, but who expects that? No other nation in the same length of time ever went anything like as far. North and south it has been the same. No other one thing gives me as much confidence in the future of the American people.

As already stated, I was in this forestry business at the start, when it was almost strictly an ideal. I took it that way for a time myself, but came soon to see that a shift of ground would promise better results, a mixing of the general idea with the affairs and interests of our people. Casual reading recently supplied the suggestion that a further shift is possible—that ideals may become idols.

In literature of the recent past it has been emphasized that the forests of the United States are the people's forests. No one, I suppose, would dissent from that. I do, however, raise the question whether it is the people as they actually are, with their diverse interests and their industries, or the people as someone pictures them in his imagination.

A fourth idea has long been in my mind, growing out of personal experience. Many times in the past, economic considerations have checked me, originating frequently with employers. Disappointment at least is the natural reaction in such circumstances, but this has usually been true when time has elapsed and I have looked back—I have concluded that such check was wholesome and desirable. That same idea I have come to apply widely. Economic considerations applied to our national conservation affairs I have come to feel are of enormous value to the American people. This element men of business training are especially equipped to supply. It is my firm belief that such men should play a part along with the specialists in our large scale planning.

In conclusion the following specific points are set down:

1. May we not take time in connection with the matters in hand, through free

and candid discussion and common counsel, to make sure that plans are sound, that they are economic, that general understanding and assent have been secured for them?

2. Shall we not rely to the fullest extent we may on the initiative and spontaneous productive forces of our people? You yourself by recent report seem so inclined, to have gone further in your thinking in fact, suggesting that private enterprise may need protection from competition of public timber. That line of consideration, especially as applied to the south, is the real motive behind this letter. The policy I suggest is that public ownership be kept out of sections in which private initiative promises to meet public need and in which there is no other clear reason for its introduction. It may or may not be known to you that the conservationists and business men of Georgia have recently, as respects their own state, taken that position.

3. In passing I will venture to mention the conservation feature of the lumber code. All I care to say is that this is a matter entirely new to many, that the considerations that should apply will frequently be debatable, in consequence that uniformly satisfactory results are not at once to be fairly expected.

The Department of Agriculture's Answer

On September 17, 1935, the following letter was sent Cary from the Department of Agriculture, Washington:

"Dear Mr. Cary:

"At the request of Secretary Wallace, I am replying to your letter of September 3. He appreciates the very evident concern which prompted the enclosure forwarded with your letter for he is, as you know, deeply interested in finding some constructive solution to that national land-use problem of which forest land-use constitutes such a vital part.

"May I add that I believe the Secretary's concern about this problem was strengthened during his recent Western trip. For on that trip he saw, first hand, many instances of these unfortunate social and economic conditions which have followed exploitation of the land itself and such natural resources as timber and forage. I judge, from what you write, that Maine has been spared the worst of such experiences. If so, she and her people are more fortunate than are many parts of the United States.

"Sincerely,

Milo Perkins,

Assistant to the Secretary."

IMPROVING FOREST FIRE DETECTION IN CALIFORNIA

By A. A. BROWN

California Forest and Range Experiment Station

For a considerable period in the California National Forest region, it has been the custom to review and analyze the failures and successes of the critical fire suppression jobs that arise each fire season. This analysis, carried on by "Boards of Fire Review," gave increasing emphasis to one critical cause of failure, lack of effective fire detection. Failures on this score were independent of the general effectiveness of personnel and equipment and often gave a degree of futility to the most carefully drawn plans. As a local issue, decided on the ground as funds seemed to permit, the development of lookouts had resulted in forest detection systems in which little attention had been given to their function as a coordinated whole. This article describes how the complex problem of selecting and distributing lookouts for their maximum efficiency in fire control was solved.

IN 1930 the efforts of the newly organized fire investigative group in the California Forest and Range Experiment Station were concentrated upon a study of detection as the key phase of fire control. Previous studies and experience had established two concrete facts that became of critical significance in this work: first, that a lookout could give dependable service only in country that he could see directly, and, second, that even in such territory his effectiveness was limited to distances of 15 miles or less. The acceptance of these limiting factors in the early work of the group at once eliminated much of the nebulous and intangible and made lookout coverage a quantity that could be determined definitely.

From the point of view of good business management it was necessary to give thought not only to the abstract nature and importance of the detection function, but also to examine in a practical way the financial limitations that enter into providing for it. The theoretical desirability of maintaining a minimum total of prevention, plus suppression, plus damage costs, can hardly be questioned. In this formula the investment for detection is a part of the total cost of suppression. As such, an increase in detection cost should either cause no increase in the suppression cost, or else it should reduce the cost of prevention or damage.

Present data permit no exact calculations, particularly in respect to damage. Even though damage could be accurately assessed, the determination of probable losses with varying degrees of detection is very uncertain. With more assurance, we can assume that wherever control of fires is attempted, an investment for their detection can be justified. Calculations with sample data demonstrate that the most clearly defined value of this investment in fire detection is reflected in reduced fire-fighting costs. Within areas of low per-acre values of destructible resource, these savings in fire-fighting cost far out-weigh any other consideration in justifying lookouts. As higher per-acre values are considered, it becomes apparent that only in localized areas, where extremely high per-acre values exist, does the value at stake and consequently potential damage become the dominant consideration. At this point increased investment in prevention, the first item of the formula, seems to be most strongly indicated. Evidently, values at stake are not a direct control factor in planning for fire detection.

The other two chief factors which are

commonly thought of as affecting need for detection are risk, or the liability of fires starting; and hazard, or the relative inflammability of the forest cover in any specific area. Comparative hazard, of course, is a relatively good measure of the potential danger of fires that do start. It is more important in highly inflammable cover to discover a fire at once than it is in less dangerous country, but it is most difficult to determine exactly how much more important. Most directly, fire hazard measures the speed necessary in protection effort. Speed, when applied to discovery of fires, can not be deliberately graduated down in a satisfactory way. In this respect, hazard fails also as a direct guide.

The factor of risk or probability of fire starting in any particular area leads itself more readily to determination. In California forests, about 76 per cent of the forest fires that occur are man-caused. In addition, this 76 per cent includes most of the expensive and disastrous conflagrations. This predominance of man-caused fires in the region has a considerable bearing on the system which was finally used for comparing detection values.

In particular, they tend to concentrate in certain areas, reflecting man's habitual activities, places of residence, and routes of travel. When plotted as spots on a map, the points of occurrence tend to form a pattern which, with time and numbers, becomes a definable thing capable of being treated on an area basis and susceptible of grading by degree. This information is provided in California fire atlases and enabled the development of a simple guide in comparing fire detection values.

Besides the three major elements discussed, which directly relate to area other items enter into the comparative detection value of any two lookouts. Some of these are the nearness of dangerous areas to observers, local atmospheric handicaps, service in "shallow" blind" areas, position of points for cross readings, and improvement costs. Such items tend to complicate the problem and preclude any exact mechanical comparison of values.

Fire detection, when considered or applied as a quantity by units, tends to be a discrete thing. It can not be applied in various degrees of dilution. Consequently it can not be scaled up or down with any expectation of a uniform result in elapsed time, as may be done by deliberately placing guards to reach areas within a prescribed travel time limit or "hour-control standard." We can not directly convert 50 per cent detection coverage, for example, into the discovery of all fires within one half hour. In effect, for any specific area, we have, or do not have, dependable detection service.

Since fire detection has distinct characteristics from other provisions for fire control, its treatment as an independent element in building fire control plans was feasible, and simplified the initial approach. The second step was toward a simple and understandable method of comparison of detection values. This was attained through selection of an important control element that could be reduced to a quantitative basis. Fire history, and the resulting probability data developed from it, provided this element.

The first work by the fire investigative group was done on the experimental area set aside on a National Forest—the Shasta —that for 30 years has been California's worst fire liability. This was the physical job of making reliable visible-area maps for existing and potential lookouts. This immediately involved an intensive study of the technic of making such maps, in many respects a new field in itself. This technic insured uniformity in their accuracy and in the results of applying them

Next, the best means of using visible

area maps to determine a coordinated fire detection system was given careful study. The factor of risk, or the relative probability of fire starting in any particular area as reflected by fire history, was selected as the important control factor which could be dealt with in a quantitative manner. At first it was contemplated that other factors would be brought in to modify the quantitative figures that were used to express the element of risk. However, in later application, the advantage of simplicity of the single control factor far outweighed any advantage to be gained by introducing other elements which, with existing data, could not be reduced to a satisfactory quantitative base.

The procedure which was developed may be briefly described. First, a base map of the fire protective area concerned was developed on which fire occurrence zones were carefully defined, first by individual causative agent, then in combination. These zones were, wherever necessary, subdivided and were colored to conform to four general degrees of risk of occurrence. From each visible-area map as it became available, a tracing was made, showing the actual area seen from the point in question. A method of crosshatching these seen areas enabled their identification when several were used in combination. Each tracing was fitted over the base map and by means of a planimeter the area covered by the crosshatching in each occurrence zone was determined in acres. The number of thousand acres seen in each zone was then multiplied by the average occurrence figure for that zone. The resulting sub-totals were added and rounded off to obtain a figure which represented the 10-year expectancy of fires and was termed the index value of that particular lookout point. This was done for each lookout or potential lookout for which maps were made. When a thorough-going field mapping program had been carried out for the whole protection unit and a rating in this way obtained for all of the points mapped, the names of the points and their corresponding ratings were arranged on a tabulating sheet in descending order. The actual selection of points to make up the detection system could then proceed.

Selection was carried out without regard for the existence of established lookouts. Usually the highest rated point was set up as the initial point in the new detection system. Its seen area tracing was placed on the base map and all other points were made to compete for the territory not already covered by it. The highest rated point on this basis was selected as lookout number 2 and the process was repeated down to a point where no further lookouts could be found that would obtain a net rating of 25 in this scale. Rechecks insured that none of the first points set up had been duplicated until they produced less net coverage than this standard. This comprised the more or less automatic part of the selection and enabled it to be done in a planwise fashion. It may be described as a "priority scheme," since in effect it sets up at each stage the maximum coverage for the minimum number of lookouts.

The preliminary studies and the model plan of procedure described had been completed and its application tried out on two protective units of the Shasta Forest by January 1, 1933. Tentative plans were at that time already made for extending the scheme gradually to all Forests of the region through training of a forest officer from each Forest in the technic and theory involved. To this end, two training schools had been held in 1932 for representatives of ten of the Forests and of the State Division of Forestry, the National Park Service, and the Los Angeles County Forestry Department.

With the inauguration of the emergency construction program in the spring of 1933, construction of the new lookouts

needed on all Forests became not only possible, but of immediate concern. The model scheme described was ready for wider application and plans were immediately made by the regional forester to put it to the test, and joint responsibility was assumed by the regional office and the experiment station for organizing and carrying through the work of detection planning as a major region-wide project.

Plans had already been made for holding a third instruction school which would complete the program of training forest officers. This instruction school was continued and enlarged to give two weeks of intensive training in visible area mapping and the field phases of detection planning to nineteen recruits, largely forest-school graduates. When the training period was completed, this group was organized into unit crews of four to six men for assignment to Forests. In this way field work, locally supervised, could go forward rapidly on at least three Forests at the same time. The major project was so organized that, beginning at the Oregon line, field work progressed systematically by Forests to winter completion at the Mexican border.

Simultaneously, an office force of eight was built up in the experiment station to develop the compilations. A huge volume of maps flowed in from the field, and their rapid assembling into logical detection plans became the first responsibility of the writer. The steps in compilation were:

(a) Setting up a master map and index of field maps for each Forest, with key numbers for each field map and for the typed field notes relating thereto.

(b) Making tracings of each map in a distinctive crosshatch indexed to correspond to field maps.

(c) By means of tracings, planimetering occurrence zones over base map and computing both total acreage and value ratings.

(d) Tabulating planimeter results for each point in order of gross values.

(e) Tentative selection of lookouts based on ratings and known modifying factors. Replanimetering of tracings at each step of selection to determine their net contribution in each new combination.

(f) Preparation of both intermediate and final composite tracings for demonstration, showing coverage of selected lookouts in combination.

(g) Preparation of alternative selections wherever decisions were in doubt.

(h) Preparation from the field notes of a summary sheet of physical improvements necessary for development of each lookout point considered in the final selection.

As the plans progressed it became more and more apparent that from a state-wide point of view the cutting off of a detection plan at Forest boundaries was unsatisfactory in the same way that the old attempts to confine it to ranger districts had been. After the first conferences, the State Forester requested the extension of the whole program to the lands protected by the State Division of Forestry. This was followed by a similar request by the County Forester's office of Los Angeles County, and by Yosemite National Park. Sequoia National Park developed a cooperative plan, and General Grant and Lassen National Parks were covered by the project incidental to the major plans in adjoining territory. In this way, because of the inherent continuity of the project, its operation became in every sense state-wide.

All these data were prepared to facilitate decisions at a series of final conferences of representatives of the regional forester, the experiment station, the Forest or Forests concerned, and whatever cooperative agencies were interested in the immediate plan. These conferences considered the findings and made final decisions, resulting in a completed detection scheme and de-

finite authorizations for the Forest supervisor upon which immediate action could be taken. The only exceptions were decisions that might be affected by plans yet to be built in adjoining territory. Such decisions were carried over to the appropriate conference.

The method of procedure at these conferences was about as follows: The key map, showing all the points that had been examined, was first considered as a means of judging the adequacy of the field program of investigation. Then, one at a time, the tracings of all important existing and potential lookout points were examined over the base map of the protection unit. These were considered in the order of their indicated values. These values were examined in a critical way to determine their validity for comparison. The burned-area maps for the last two decades and the fire history maps which had been used in developing fire occurrence zones were often valuable reference in this connection. After a clear idea had been obtained in this way of just what localities were the distinctive contribution of each of the important points, the tentative selection of lookouts for the final scheme was gone through, one step at a time. Wherever two closely competing points were involved, every possible factor that should influence the decision was brought up for consideration.

The definite rating figures, considered to be accurate within 10 per cent, were a most helpful guide in many of the controversies that arose. Often a long established lookout, whose value had never been questioned by the Forest, from which a beautiful panorama was obtained by visiting Forest officers, fared very badly when subjected to the valuation test. Although, in theory, the selection was designed to obtain the greatest coverage with the smallest number of lookouts, it was found that duplicate coverage was automatically obtained in about two-thirds of the seen area, and that this duplication tended to fall in the important danger areas. On six of the Forests, the most valuable potential detection point found had not previously been used for a lookout.

The results of selection on the Mendocino Forest are demonstrated by Figure 1. It was one of these six Forests, and shows a spread in detection efficiency beginning with the first lookout. On others

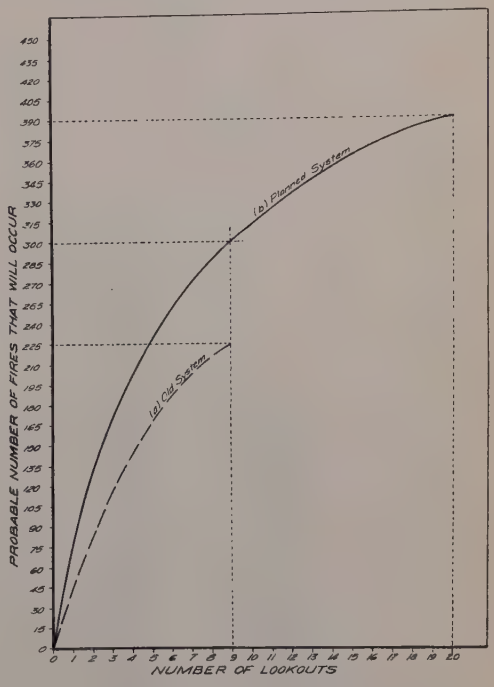

Fig. 1.—Efficiency comparison, old system vs. planned system, Mendocino National Forest. Shows cumulative number of fires included in directly seen territory as covered (a) by existing lookouts set up in order of importance, (b) by planned lookouts set up in the same way.

If the first nine lookouts set up in the new system had been in existence during the preceding ten years instead of the nine existing lookouts, 300 fires would have occurred in territory directly visible to them instead of the 225 that occurred in territory actually seen. See curve "b." This indicates a gain for the same detection investment of 33-1/3 per cent. The gain in total area covered within a 15-mile limit of at least one lookout was equally impressive. See Figure 2.

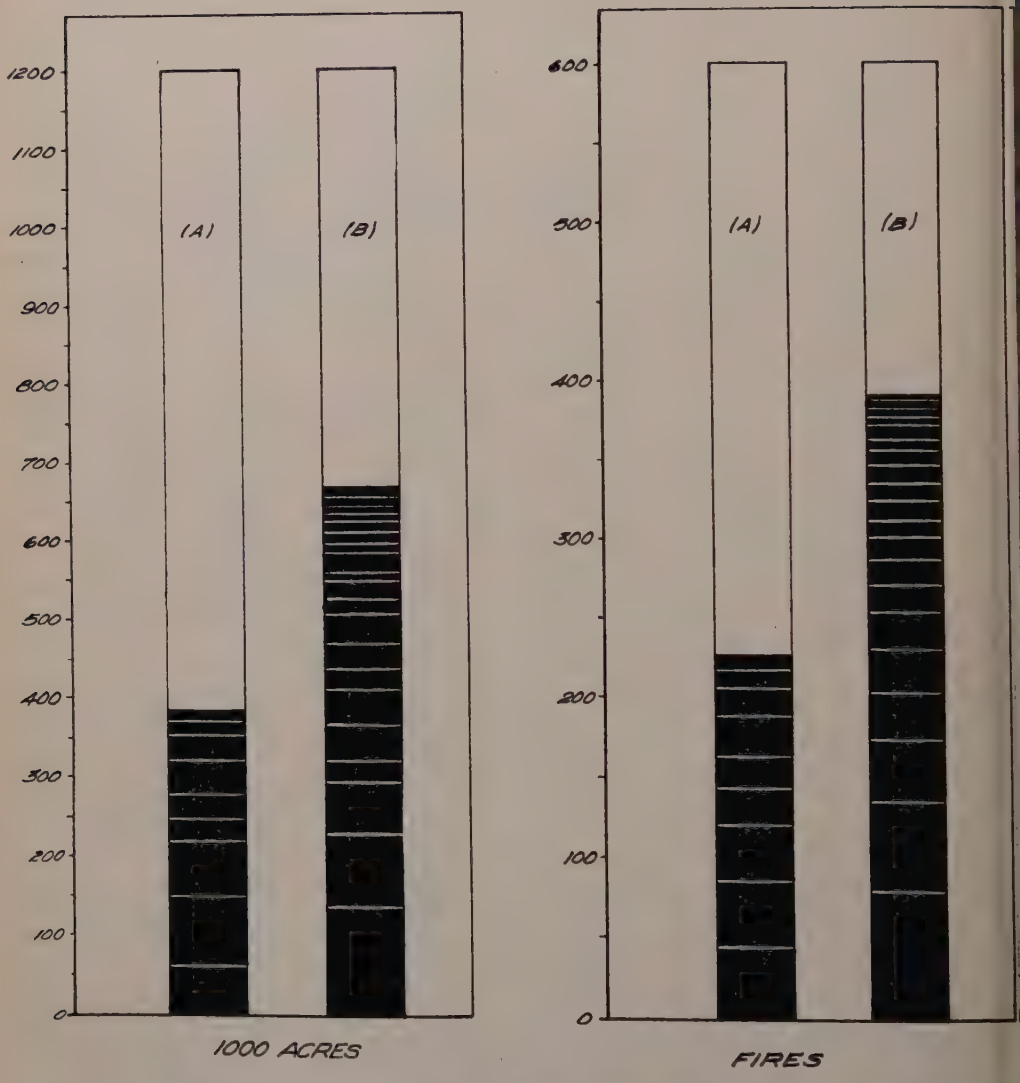

Fig. 2.—Successive additions to acreage and fires directly seen by increasing the number of lookouts (A) by former local selection (B) by planned selection. The two bars at the right repeat the data shown in Figure 1. Each block of the bar progressing upward represents the net contribution, in probable number of fires in visible territory, added by each successive lookout to that of the preceding ones. The two bars at the left show the same data in terms of acreage of territory covered. Because of the emphasis on frequency of fire occurrence in the planning method, it is to be noted that there is a greater gain in territory in which fires have been frequent than in total acreage, as represented by the two bars at the left. See preceding comments on the law of diminishing returns, which is well illustrated here.

the curves coincide in varying degrees up to a maximum on the Tahoe, where the first three lookouts in both the planned and existing systems are identical points. It will be noted that detection standards were raised, in addition to the gain obtained by planned selection. In this case all the points beyond the first six will serve the lookout-fireman function.

To deal by the conference method with important administrative matters is by no means a new or unusual procedure. The distinctive value of the method here described lies in the preparatory work, whereby a graphic, analytic approach was provided, as many factors as possible were reduced to a simple quantitative basis, and only such unmeasured elements were introduced for decision as applied in the individual cases. While comparative inflammability of the cover or hazard was treated as one of these more intangible elements, it was not discounted as a dominant consideration in the general protection scheme. Hazard seldom varied widely within the coverage of two closely competing lookouts, but wherever significant variations did exist they were more definitely taken account of by the combined judgment represented at the conference as applied to the specific localities under discussion than would have been the case had existing data been used to modify the mathematical rating scheme.

The simplicity of the rating scheme made it easy to refer it back in any instance to the supporting data in the form of the original spot maps by causes and periods and the burned-area record. In one instance, where the advantage of a new lookout in covering a highly rated "blind" area was much discounted by the local force, before the new lookout could be installed three class C fires occurred in this area, none of which was reported by the existing lookouts in time to prevent a high suppression bill. The new lookout location sold itself. The 1934 fire season has already given further emphasis to the value of many of the new locations.

The particular significance of the so-called law of diminishing returns in relation to protection planning is that, as fire protection provisions are intensified, it becomes increasingly difficult to obtain an adequate return from additional investments. Figure 2 illustrates this. Notice the logarithmic tendency in bar "B" at the right. The new territory covered by each successive lookout becomes less and less at a geometric ratio as the number is increased. Actually, however, decrease in added detection value with increase in number of lookouts is less than indicated by this bar, because of the value of duplicate coverage in danger areas. Nevertheless, the need of careful planning increases in direct ratio with this tendency toward diminished returns and applies wherever limitations prohibit one hundred per cent realization of any particular objective or deal. Such an unattainable ideal in fire detection might be visualized as a situation in which every square foot of inflammable cover was continually under the watchful eye of a lookout.

The foregoing has indicated the statewide scope of this project. In the 11 months in which it was conducted, the 19 men in the field crews became known almost professionally as "visibility mappers" and could lay claim to conquering more elevation than most professional mountain climbers. Some of the story in statistics is:

Total number of points from which visible area maps were made and field notes prepared	1,337
Total number of tracings which were prepared and planimetered at least twice	1,378
Composite tracings of seen areas in combination, prepared for conference use	50

Number of conferences held 19
Number of lookout points set up in national forest plans 168
Number of established forest lookouts abandoned 36
Additional points approved for the State Division of Forestry 58
Territory covered—Work in 50 of the 58 counties in the state.
Organizations concerned—All fire control organizations in the state.

The trend of occurrence of all fires in the region for 1933 by the probability zones set up is shown in Table 1.

These figures are adjusted to compare directly with the figures for the number of fires occurring per thousand acres during a 10-year period. The number of fires in 1933 was well below the 10-year average, yet the trend by zones is well borne out. Note that there is better than a 30 to 1 chance of a fire starting on any particular acre within zone 4 as compared to an acre in zone 1.

The detection planning project as carried out in the California National Forest region has demonstrated several things of value in projects of this kind. Although it is not, in itself, a perfect method, nor considered to offer a ready formula for similar work in other regions, nevertheless certain elements of the method have already been valuable in the approach to other phases of fire-control planning.

Perhaps the most significant feature is the possibility of treating a complex problem by singling out one or two controlling factors which can be treated in a quantitative way and using them to set up an orderly method of examining the more qualitative factors as they actually bear on specific instances. Such a method permits the highest use of experienced judgment by directing it to properly defined problems.

The value of simplicity in a rating scheme was amply demonstrated. The

TABLE 1

OCCURRENCE OF FIRES BY PROBABILITY ZONES

	Zone 1	Zone 2	Zone 3	Zone 4
Avg. of rates of occurrence for period 1923-32[1]	.25	2.09	5.97	14.29
1933 fires	.30	1.07	3.53	11.45

[1]As already explained, lightning fires, rated at half value, are included for the longer period of 1913-32.

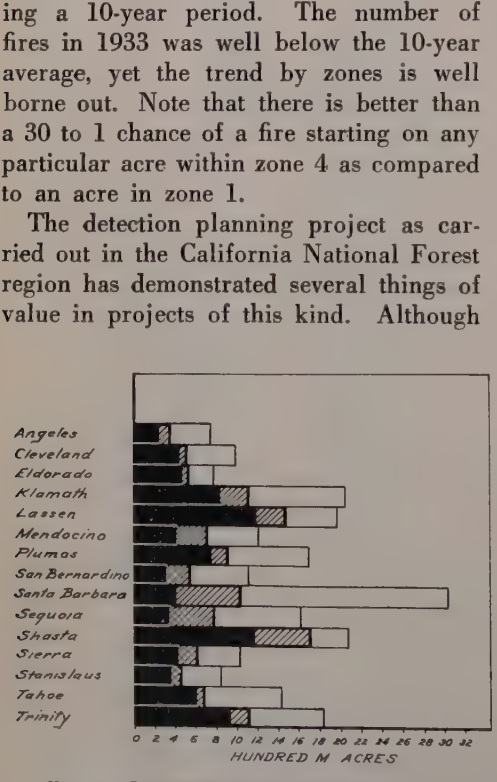

Fig. 3.—Improvements in detection coverage obtained by systematic planning on 15 California forests. In these graphs, the improvement gained in detection coverage for the 15 National Forests for which complete plans were made is shown. The left graph shows in black the amount of territory directly seen by lookouts with the former detection systems; the crosshatched areas represent the additional territory gained as a result of the detection planning project. The right graph gives the same data in terms of the probable number of fires in territory directly seen. The white part of the bars represents the remainder of the protection unit not covered directly by lookouts.

ratings used meant only one thing, and were easily explained and understood. They could be referred to their source whenever brought into question and their exact significance judged in any instance. As the project progressed, it became evident that a more complex scheme would be valuable only if it could be assumed that the results obtained were a final and scientific answer, since any exercise of the judgment on a composite rating scheme is necessarily arbitrary.

The significance of inflammability or rate of spread as a measure of detection value was considered to be less direct than occurrence, as outlined at the beginning of this paper. It was used as a modifying factor but could well be incorporated in a numerical rating scheme if an accurate basis were developed. Such a basis was not available when this project was initiated.

The application of the law of diminishing returns has particular significance in detection planning, as illustrated in Figures 1 and 2. The principle concerned is of wide application in all fire-control planning.

As a cooperative effort, designed to bridge quickly the gap between investigation and final application, successfully carried out to a logical conclusion, touching as it did every corner of the state, catching the imagination and winning the support of many individuals and organizations, and consequently growing into a state-wide pattern of an integrated detection system, this project has developed and strengthened the teamwork essential to successful state-wide fire control.

PROGRESS REPORT OF THE RECLAMATION OF SEVERELY WEEVILED WHITE PINE PLANTATIONS

By A. C. CLINE[1] and H. J. MacALONEY[2]

A method of reclaiming severely weeviled white pine plantations was developed in 1930. Observations carried on for a four-year period show that the pruned trees are improving. Most of the girdled trees have died, and the stand has been opened gradually. The method has worked out satisfactorily according to the expectations of the authors.

IN 1930 the authors developed a method of improving white pine plantations severely injured by attacks of the white pine weevil (*Pissodes strobi* Peck). This method, which involves the selection and pruning of a sufficient number of the best-formed trees to make the final stand and the elimination by girdling of the overtopping poorly-formed trees, was described in a bulletin published in 1931 by the Massachusetts Forestry Association.[3] Since the dominant crown class contains by far the highest percentage of severely injured trees, desirable crop trees are found chiefly in the codominant and intermediate crown classes. The trees to be eliminated by girdling are almost exclusively scrubby dominants. None of the overtopped trees should be pruned, as they are too small and weak-crowned; and, in addition, it is advisable to include only the more thrifty individuals of the intermediates. Generally not more than 200 to 400 trees per acre should be selected for pruning. In a later publication by the Connecticut Forest and Park Association[4] the authors discussed special measures to correct forked and crooked stems.

It was stated in these publications that plantations having a spacing not wider than 6 to 7 feet contain enough well-formed crop trees to permit the development of a full crop at maturity, even with extreme weeviling. The authors still assert this to be the case, but it is equally true that with wider spacings, such as 8 x 8 feet, it is impossible to find enough good trees to make a full crop. The costs of the operation when applied on a practical scale have shown some variation, owing to the number of trees pruned per acre, the age of the stand, and other factors. Labor cost figures for the first two treatments, or their equivalent,[5] supplied by the Harvard Forest, the Crane plantations at Dalton, Mass., and the Choate plantations at Petersham, Mass., ranged from $8.65 to $12.50 per acre. In all cases pruning was done with handsaws and ladders. The final treatment to complete the pruning and girdling should not cost more than $6 per acre, making a total of about $18. This closely approximates the estimated cost stated by the authors in their original publication (1931). It should be recalled that the first treatment is the most costly, since it carries the added expense of selecting the individual trees to be pruned.

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[1]Assistant Director, Harvard Forest, Petersham, Mass.

[2]Assistant Entomologist, Division of Forest Insects, Bureau of Entomology and Plant Quarantine. In cooperation with the Northeastern Forest Experiment Station, New Haven, Conn.

[3]Cline, A. C., and MacAloney, H. J. A method of reclaiming severely weeviled white pine plantations. Mass. For. Assoc. Bull. 152, 12 pp., illus. 1931.

[4]Cline, A. C., and MacAloney, H. J. Additional notes on the improvement of weeviled white pine plantations. Conn. For. and Park Assoc. Pub. 24, 11 pp., illus. 1933.

[5]The lower cost is due to comparatively few trees being pruned per acre.

Re-examination of Sample Plots

In the spring of 1930 4 sample plots were established for the purpose of making detailed observations of the progress in stand improvement. With the passing of 4 growing seasons since the first treatment some definite results may be noted.

1. *The Pruned Trees.*—It is very evident that live-limb cuts heal more rapidly than dead-limb cuts. In the former, callus tissue starts to develop the first growing season after pruning, and at the end of 4 growing seasons the healing of average-size limbs is somewhat over one-half complete. From 3 to 6 more years will be required for complete occlusion, depending upon limb size and the vigor of the tree. Since no living tissue is severed in the removal of dead limbs, the prompt development of callus is lacking, and the rate of occlusion is less than in the case of live-limb cuts. The most commonly observed condition, within 2 years after pruning, is a collar of dead bark, forced outward by growth in the bole, surrounding a depression in the bottom of which fully three-quarters of the area of the limb base is visible. Four years after pruning the proportion of area healed is still noticeably less than with live-limb cuts.

Fully one-half of all the live-limb cuts were completely pitched over within a year after pruning. Cases of partial pitching were limited in general to the largest cuts—upward of 2 inches in diameter. Obviously, there is no exudation of pitch immediately resulting from dead-limb cuts, although some pitching may be in evidence within 2 or 3 years. Most forest pathologists consider the pitch seal a safeguard against the entrance of fungi, and for this reason it is preferable to start pruning before the zone of dead branches extends more than a few feet above ground, and before even the largest limbs exceed 1½ inches in diameter.

Some evidence of the effect which girdling the severely weeviled "scrubs" has on diameter growth of the pruned crop trees was obtained by a comparison of diameter increases for the last 4 years. This involved separating diameter measurements on the basis of whether or not the pruned tree had grown under conditions of reduced competition through the girdling of a neighboring tree. In 2 of the 4 sample plots laid out in 1930 the overtopping "scrubs" were girdled; in one they were topped so as drastically to reduce their crowns; and in the fourth there was no treatment other than pruning of the desirable trees, because the stand was too young to be in need of it. In the following table, based on two sample plots, an unmistakable tendency is indicated, though the data are too limited to be conclusive.

Table 1 shows that diameter growth in the pruned trees situated next to girdled trees has been substantially greater than in those that were too distant to benefit by reduced competition. Especially significant is the response of trees in the intermediate crown class. This may be interpreted as indicating that normally vigorous intermediates (small-crowned intermediates were not favored as crop trees) may be depended upon to make satisfac-

Table 1.

DIAMETER GROWTH OF PRUNED TREES FOR A 4-YEAR PERIOD FOLLOWING TREATMENT
(Based on a total of 87 trees)

		Average diameter increases in inches by crown class		
		Intermediate Inches	Codominant Inches	Dominant Inches
Case 1. Plantation 25 years old in 1930	A	0.91[1]	0.93	1.05
	B	.60	.81	.93
Difference		.31	.12	.12
Case 2. Plantation 18 years old in 1930	A	.70	.77	1.05
	B	.44	.53	.82
Difference		.26	.24	.23

A, One or more neighboring trees girdled.
B, None of the neighboring trees girdled.
[1]Four years' growth in diameter at breast height.

tory crop trees. Previously, doubt had existed in the author's minds as to whether the growth of intermediates could be increased sufficiently to permit their taking a dominant position in the final crop.

With respect to the influence of pruning on height growth, no significant differences were noted between pruned and unpruned trees. This undoubtedly is due to the conservative degree of pruning—approximately to one-half the total height of the tree. The possibility that pruning 2 or 3 whorls of live branches might reduce weevil attack for a year or two has been suggested. This was based on the assumption that live-limb pruning would reduce

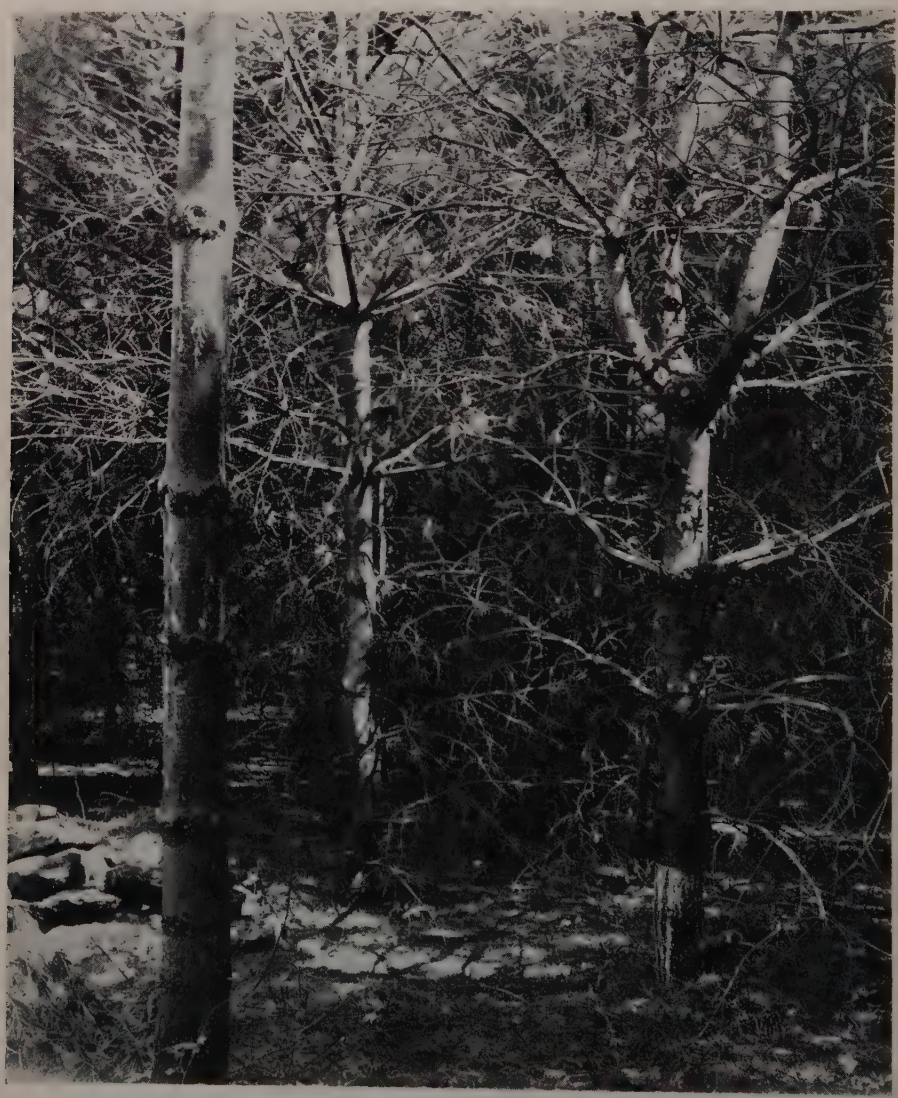

Fig. 1.—Twenty-year-old white pine plantations, showing a well-formed tree, pruned, and a severely weeviled "scrub," girdled and dead. The first treatment was made in 1930; the second in 1934. Although the girdled tree has been riddled by bark beetles and wood borers, the pruned tree has not been attacked.

the vigor and size of the leader, thereby making it less attractive to the weevil. A tree-by-tree record of weevil attacks in the sample plots for the first two seasons following pruning showed that there was no appreciable difference between pruned and unpruned trees so far as susceptibility to attack was concerned. The removal of a very large portion of the green crown undoubtedly reduces the growth of the tree temporarily, and might influence weeviling to some extent during the period of recovery.

Occasionally the pitch-mass borer (*Parharmonia pini* Kell.) has entered where live limbs were pruned, especially in older plantations. Tunneling is limited to the immediate vicinity of the cut, and it is doubtful if any appreciable defect results, although the burrows retard or prevent healing. The pitch midge (*Retinodiplosis* sp.), which lives within the exuded pitch of the cuts, occurs more commonly than the pitch-mass borer, but does no tunneling under the bark and causes no apparent damage.

2. *The Girdled Trees.*—Out of 42 trees girdled with a chain saw 21 died within 2 years, and 11 more during the next 2 years. The remaining 10 are at present dying. These 10 include 4 trees with bridged girdles, apparently made possible by too shallow a cut with the chain saw. These trees were regirdled in April, 1934. The remaining 6 trees of those still alive show a marked increase in diameter above the girdles, as compared with that below, indicating a stoppage of the downward passage of elaborated food at the point of girdling.[6] This condition also is believed to be associated with shallow girdling. It is also possible that root grafting may be a factor in these cases.

In practice, girdled trees remaining alive for longer than the period between treatments should be regirdled. Evidence points to a relationship between the depth of the cut and the time required to kill the tree; that is, the deeper the cut the shorter the length of time required. It should be pointed out, however, that very deep cuts may result in the breaking off of the tree at the girdle. This defeats the purpose of girdling, namely, that of affording the greatest amount of protection and support to the crop trees during the period of readjustment. Sun scald and snowbreak have been observed in cases where the weeviled "scrubs" were cut rather than girdled.

For practical purposes, in plantations of pruning age it appears advisable to instruct the workmen to make chain-saw cuts about half an inch deep, including bark thickness. Trees girdled 4 years ago and now dead are still standing intact, and it appears certain that their break-up will be gradual. Meanwhile, though they are no longer taking nutrients from the soil, they afford support and protection to the crop trees and retard the growth of branches that will not be removed until the final pruning. Several species of wood borers and bark beetles attacked the girdled trees, but not the pruned trees.

By way of summary, it may be stated that thus far the method developed for reclaiming severely weeviled white pine plantations has worked out satisfactorily and in accordance with the expectations of the authors, as expressed in the original publication in 1931. The final treatment will be made in 1936, at which time a further progress report will be in order.

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[6] Incidentally, the authors have observed the same phenomenon in the case of Scotch pine girdled near the base by rodents.

BRIEFER ARTICLES AND NOTES

The Forest Tax Law

When the 10-mill levy went into effect on real estate in Ohio, a huge amount of revenue was removed from land and shifted to other sources of taxable wealth. Probably little or no thought was given to the effect this would have on forest or timber lands. The net result, however, was a tremendous lightening of the tax burden on forest and wooded areas, along with other real estate. This method of reduction by limiting the mill levy on all lands accomplished more in saving taxes on timber lands, and in a shorter period, than could be attained through special forest tax laws, which usually have to be so complex that they are not workable.

According to estimates, approximately 3,500,000 acres of forest land in the state would qualify as taxable. With an average value of $15.00 per acre the forest land of the state would have an appraised value of $52,500,000. Before the 10-mill levy went into effect probably the average tax rate upon the lands was 2 mills, making a total of $1,050,000 collected from the lands for revenue purposes, or 30 cents per acre per year. This is not a very large sum; surely an acre of forest land not capable of producing each year in wood growth that amount and considerably more is not worthy of being called timber-producing. With the 10-mill levy in effect and no material increase in value of the forest lands, probably $525,000 was shifted from these areas and the average tax per acre of timber land cut to only 15 cents per acre.

This seems low enough not to discourage even the most skeptical from planting trees on $15 per acre land. Over a long period of years only fair-growing timber should produce at least $2 per acre per year in timber products. This leaves a considerable margin for interest and rental charges, after the taxes are taken out, provided land values do not increase and the forest land is outside of a district where the levy can be increased by a majority vote of the people.

The question now arises what effect this will have upon Ohio's present forest tax law. This law, enacted in 1925, specifies that all lands devoted exclusively to forestry or timber growing and protected from grazing are eligible for classification under the law. When properly examined by a member of the department of forestry and certified to the county auditor, the local taxing district rate is reduced one-half on the forest land acreage. With the existing 10-mill levy, under the special forest tax law forest lands properly certified are reduced to 5 mills. Up to January 1, 1935, 605 forest areas had been classified under the act, totaling 52,650 acres. However, the law also provides for a 5 per cent stumpage tax assessed against all timber products when they are sold. With the blanket reduction on all land now limiting the rate to 10 mills, the forest tax law may become obsolete.

Take for example a 50-acre woods classified under the forest tax law, having an average value per acre of $15 and a total value of $750; the value of the standing timber and growing stock not to be considered. With the tax rate of 10 mills reduced one-half under the forest tax law, a saving of $3.75 would be realized each year. For a 25-year period the savings would amount to $93.75. But if at the end of the 25 years the merchantable timber was sold subject to the 5

per cent yield tax, saving could be easily erased. A timber growth increase of 200 board feet per acre per year would total at the end of 25 years, on the 50 acres, 250,000 board feet. At $10 per thousand this would have a total stumpage value of $2,500, on which the 5 per cent stumpage tax would come to $125. The net result, disregarding interest, would be a loss of $31.25 under the forest tax law, or $1.25 each year.

Other factors, however, may favor the special forest tax law, such as increased land values, special assessments, low rate of timber growth, and reduced stumpage prices. Yet it would seem little is to be gained, if any, in tax saving under the forest tax law as long as the 10-mill levy limitation remains effective and forest land values are not increased materially within the next few years.

F. W. Dean,
Extension Forester, Ohio.

Experimental Forestry in Soviet Armenia[1]

Only 8.2 per cent of the territory of the Armenian Republic, or 711,000 acres, is forested. Enlargement of the forest area and intensive management of existing forests are imperative, therefore, in order to supply the forest products required by the dense population.

The forests, which lie mostly in the mountains between 2,300 and 7,200 feet above sea level, vary widely in composition and are quite unlike those of central Russia. The principal species are *Fagus orientalis, Carpinus betulus, C. orientalis, Quercus macranthera, Q. iberica.* and *Tilia cordata,* with scattered groups of *Pinus hamata* and junipers.

Prior to the Revolution no scientific research had been done in the Armenian forests, and they were much exploited. Research work was begun in 1925. In 1929 a forest experiment station was established near Karaklis, with an arboretum and a 3,000-acre experimental forest. The work is carried on by a permanent staff of three technicians and numerous temporary assistants, mostly students at the Tiflis Forestry Institute. Urgent problems concerned natural regeneration as influenced by methods of cutting, biology of various trees and forest types, and artificial forestation. So far, work has been concentrated on them, with less attention to logging technic and the use of animals in timber transportation.

Investigation of the effect of different cutting methods upon natural regeneration was facilitated by the absence of systematic forest management and the consequent great diversity of cutting methods employed in the past, from very gradual selection to clear cutting. Conclusions based on old cuttings were checked by means of control plots in the experimental forest. Methods of cutting have now been worked out for the principal forest types. Among other things, it has been found that oriental beech forest can be regenerated by 2 or 3 cuttings within 5 to 10 years, whereas in western European beech forests 6 or 7 cuttings are required, extending through 25 to 30 years. *Carpinus-Tilia* stands reproduce well after clear-cutting, from seed already on the ground. The productivity of oak forests on poor sites can be increased by interplanting of pine.

Investigations in forest planting technic have been conducted both on the experimental forest and on a special "rocky reservation park," where the use of paper and other mulches has made it possible

[1]Abstract of article by G. Yaroshenko, Scnior Scientific Collaborator of the Forest Experiment Station, Karaklis.

to establish pine plantations on extremely unfavorable sites. Some work has also been done on cultivation of various species in the arboretum. It is planned to give major attention, during the next 5-year period, to problems of forest planting and cultivation of park and ornamental trees.

The station has published the following: the pine and oak of Armenia, 1929; research on biology of eastern beech, 1933; a method of precise determination of the age of beech trees, 1933; the course of height growth of eastern beech in Armenia, 1933; foot planting stake and brigade method of labor in forest cultivation, 1934.

Reports soon to be published deal with natural regeneration and methods of cutting in the principal types of forest, defects of beech, and the use of oxen for transportation of timber.

American institutions or individuals interested in exchange of information, tree seed, or scientific publications should address: Forest Experiment Station (Lesnaya Opytnaya Stanzia) Kirovakan (Karaklis-Lory) Armenia, U.S.S.R.

W. N. Sparhawk,
U. S. Forest Service, Washington, D. C.

Clear Cutting for Acid Wood in Delaware County, N. Y.

In the summer of 1931 Mr. George Treyz, of Cooks Falls, Delaware County, N. Y., a prominent acid wood operator, invited a group of foresters to inspect his 5,000-acre operations in the Catskills.

Clear cutting in narrow blocks up and down the steep slope of the mountains has been Mr. Treyz' practice for many years. In fact he has recently been going back for a second cut of 25 standard cords to the acre in tracts previously clear cut from 35 to 40 years ago. Coupled with this clear cutting policy has been a rigid system of fire protection that has kept yearly damage from fire well under one-tenth of one per cent of the total area.

On this visit in 1931 foresters were amazed to see stands of successive one-year classes from one up to forty, each stand a little bigger than the preceding until the 40-year climax was reached, where the harvesting of the second crop could be witnessed. All of the stands were densely stocked, and with a considerable proportion of birch and hard maple. We foresters asked ourselves, "How differently would we have handled this property under such difficult topographic conditions, with cordwood the ultimate product required?"

In the summer of 1934, in connection with building up a motion picture library of the forest products industries of the state, I had occasion to spend several days in a further inspection of what has happened on these steep mountain slopes clear cut in the first decades of this century. Without exception they were covered with thrifty stands of mixed seedling and sprout origin.

What about the composition of such stands? At the time of this visit the writer was chiefly concerned with the actual logging operations, and opportunity did not present itself for a detailed and statistical analysis of existing stands either as regarded percentage representation by species or as to proportionate representation between seedling and sprout origin. It is the writer's belief, however, from observation that these stands following clear cutting are satisfactory from the standpoint of the presence of desirable species.

In the years immediately following clear cutting, bears and the natives feast on raspberries to their hearts' content. Then come fire cherry, aspen, striped ma-

ple, and soft maple, to be followed by the permanent species typical of the region—hard maple, yellow birch, and beech, with lesser amounts of basswood, black cherry, and white ash.

Illick in his bulletin 46, Beech, Birch, Maple in Pennsylvania, recognizes the uniform excellence of stands following clear cutting for acid wood. In fact his yield tables are based on sample plots taken in such stands. E. H. Frothingham in bulletin 285 on the Northern Hardwood Forest publishes similar records of sample plots, taken in stands following acid wood cuttings in Delaware County, N. Y.

Sugar maple, as all foresters of the northeast recognize, is the most aggressive reproducer throughout the beech-birch-maple type, due to a combination of prolific and frequent seeding and high tolerance. Yellow birch, while not so tolerant, is equally aggressive in its reproductiveness. From the standpoint of the acid wood operator these species represent two of the best trees for the purpose of destructive distillation. On the face of the matter the present practices are certainly sound financially or this particular acid wood operation would not have survived the depression. The proof that these present cutting practices are not sound silviculturally has yet to be demonstrated.

J. A. Cope,
Extension Forester,
N. Y. State.

Winter Injury to Hardwoods in 1933-34

Residents of New York State will long remember the winter of 1933-34 for its abnormally low temperatures sustained over comparatively long periods of time. In the fruit belt along Lake Ontario, sweet cherry and peach trees were killed outright. Of apple varieties, the supposedly hardy Baldwin died by the thousands.

On the shores of Lake Cayuga, some 30 miles north of Ithaca, a seedling *Sequoia gigantea* was planted by a returning sea captain in or about the year 1825. For over a hundred years it had grown thriftily in its new environment until it had reached a height of 70 feet and a diameter breast high of approximately 20 inches. But the winter of 1933-1934 was apparently too severe. An inspection as late as November, 1934, showed the entire crown brown and sere. On the strength of this evidence one is tempted to say there has been no winter like that of 1933-34 in central New York for over 100 years.

Even our native hardwoods did not entirely escape winter injury, particularly in the northern parts of the state. It was repeatedly observed during the following summer that in exposed places in the foothills on the western side of the Adirondacks five- and six-inch sugar maples and beech failed to leaf out. The bark cracked and curled up on the main stem, and vigorous sprouting was in evidence, just as if the area had been swept by a fire. In similar exposed sites the hemlock, spruce, and yellow birch seemed not to have been affected.

Winter Injury to Reproduction

One of the most unusual phenomenon in connection with the low temperatures was brought to the writer's personal attention in St. Lawrence County, N. Y., eight miles south of Canton, latitude 44° 30′, longitude 75° 10′. A 125-acre hardwood area had been logged to a 12 inch stump diameter limit in 1929-30. The present owner had acquired the area immediately after logging and proceeded at once to work up all the tops into fire wood, and in addition to cut all defective and deformed trees left by the loggers. The cord wood obtained and sold from this area had returned sufficient

revenue to pay not only for the cost of cutting but also for the original purchase of the cut over land. Since this tract had not been grazed or burned within recent decades at least, there was present on the forest floor at the time of logging considerable advance growth, particularly of hard maple, ash, hickory, and basswood. The logging of 1929-1930 stimulated this reproduction, and the clean-up work following further improved growing conditions in this thrifty understory. By the fall of 1933 the reproduction was, on the average, about 6 feet high. It was made up, in the portions observed, of about 65 per cent maple, 20 per cent white ash, 10 per cent basswood, and 5 per cent miscellaneous. The ash, where not badly suppressed, was on a level with the maple, though obviously of post-logging origin. The basswood was quite a bit lower, and it seemed doubtful if many of the seedlings could survive the overhead competition.

Then came the winter of 1933-1934. Sample records taken from the Canton station of the U. S. Weather Bureau, 8 miles north of this woodlot, indicate the severity of the cold weather.

DATE	DEGREES BELOW ZERO
November 16	2
December 20	30
December 29	34
January 18	16
January 20	19
January 29	16
January 30	16
February 5	20
February 6	24
February 8	25
February 9	28
February 16	27
February 17	28
March 2	2

The visit to the tract in November, 1934, revealed some interesting notes in regard to the relative frost hardiness of species, in this particular location. In the flat, low-lying sections of this tract, with a minimum of sheltering overwood, the maple seedlings had been for the most part killed clear to the base. Vigorous sprouts from the roots came up the following spring. At the time of the visit they had hardened for the winter. The white ash was killed back to a uniform height above ground of about 2 feet. This may have been the snow line, although this point could not be verified. Suckering from adventitious buds along the stem below the 2 foot level was prevalent. The basswood had come through the winter without apparent injury. Repeated search failed to reveal one damaged basswood seedling.

Thus the severe killing back of the ash and maple reproduction had acted as a release cutting for the basswood.

J. A. Cope,
Extension Forester,
N. Y. State.

Truck Trails and Firebreaks; Their Use by Deer on the Santa Barbara National Forest

The construction of additional truck trails and firebreaks has caused considerable comment by local sportsmen and others who feel that these modern methods of transportation will react unfavorably on the deer population.

The Forest Service has been criticized for opening up hitherto inaccesible areas; and questions have been asked regarding the effect upon game animals of this invasion into new territory. It has been stated that the deer will desert the area slashed by road or firebreak; that no advantage to the game population can result from our accepted measures of protection.

Due to the unusual amount of interest displayed, the writer has taken every opportunity to examine many of the truck trails and firebreaks at various elevations

and aspects that have been constructed within the history of the CCC on this Forest. Particular attention was given to the more recent openings into (undisturbed) large brushfields where the cover is almost entirely of one or two species.

This condition is quite common on the Santa Barbara National Forest, where many thousands of acres of watershed slopes may consist of 90 per cent chamise (*Adenostoma fasciculatum*). Repeated fires have wrought havoc with other kinds of brush less fire-resistant, and we now have huge areas where chamise has completely taken over the burned country.

It is a well established fact that mixed types of cover afford the best habitat for the California mule deer of both Santa Barbara and Ventura Counties, as indeed for any other species or portion of this state. Dense fields of chamise for example, while of tremendous value as watershed cover, offer comparatively little as feed. The same can be said of scrub oak (*Quercus dumosa*), manzanita (*Arctostaphylos glauca*), and buckbrush (*Ceanothus cuneatus*) that also cover so much of mountain sides below the 5,000 foot contours. However, isolated shrubs of all these species, or those that fringe the major type, will show fairly uniform utilization by deer.[1]

The necessary removal of any dense brush for a road or firebreak unquestionably affects the vegetative cover in the immediate vicinity of the opening. With the change in ecological conditions a new cover of quick growing annual weeds and grasses forms rapidly within the cleared or grubbed area. A mixed type is created, and deer are very quick to take advantage of any change, whether it be due to natural causes or man-made.

The question if deer will leave the area because of new roads or firebreaks brings up some interesting facts that give a negative answer. The location of a firebreak is usually along the crest of a prominent ridge, and may be extended by lateral lines along the tops of minor ridges that depart from the main divide. The crests of these principal and secondary divides are used by deer in their normal travel, and many of the cleared lines 50 feet or more in width have well defined deer trails along the sides or middle. Typical of their adaptability to a change of condition or environment, the deer have quickly taken quite literally the path of least resistance.

An excellent illustration of this can be seen on the Wheeler Gorge—Nordoff Peak firebreak near Ojai. This cleared line extends along the top of a prominent ridge through dense brush for a distance of about 5 miles. Previous to the construction of the firebreak deer travelled the crest only occasionally. The ridges and summit had little to offer in food except chamise, and the nearest water from Nordoff Peak is about 1,500 feet below. Only very few deer were reported in the high country by the occasional hunter or traveller that made the long winding climb by trail to the peak. This year a dozen were seen by the crew building a lookout station, and I counted more than that number on an early morning trip in June. Both the roadway and firebreak, from their start at the shady canyon of Matilija Creek to the finish at Nordoff Peak, show ample evidence of travel by deer, and the new growth of cut shrubs has been consistently browsed all along the way.

The browsing of these tender shoots of oak, sugar bush (*Rhus ovata*), and chamise is quite striking as there is an abundance of all three species in full growth

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[1]Robinson, Cyril S. Feeding habits and forage requirements of rocky mountain mule deer in the Sierra Nevada Mountains. Jour. of For. 29:557-564, 1931.

on both sides of the road. Forage species of high value that are scattered among the mass of chamise and within easy distance of the new openings have been grazed very closely within the past few months. Annual grasses and weeds, now increased by the removal of the canopy of brush, have also signs of cropping and no doubt will be well utilized by the deer in the early spring.

Some of the most favored feeding grounds of our deer are these long broad topped ridges where the vegetation is more scattered. Here you will find a variety of forage species that cannot survive the competition of the dense stand. That the deer will continue to use these natural feeding grounds is not surprising, and I venture to state that distribution in many cases has been aided very materially by the introduction of an easy passage across many a brushy hill or mountain. Both large and small members of the fur-bearing animal family may also find these modern ways useful in their constant moving life within the great chaparral forests of the Santa Barbara.

Cyril S. Robinson,
U. S. Forest Service.

REVIEWS

Manual of the Grasses of the United States. By A. S. Hitchcock. *U. S. Dept. Agr. Misc. Pub. 200, 1935, pp. 1040, figs. 1696.*

Only once in a while is it possible to single out a new book and hail it as a landmark in science. Hitchcock's grass manual of the United States is unquestionably such a landmark in taxonomic agrostology, and automatically takes its place as easily the one authoritative work in its field. Its forerunner, Beal's rather rambling 2-volume "Grasses of North America," published in 1896, is now hopelessly antiquated and out-moded.

Prof. Hitchcock needs no introduction as an agrostologist. He is the director of the grass collection of the U. S. National Herbarium, the largest assemblage of grass exsiccatae in the world, and is the prolific author of widely recognized, authoritative technical publications which have flowed in a steady stream from his fecund pen. He has brought to this manual nearly a half century of active botanical experience, coupled with the enormous resources of the two federal organizations he represents.

Grasses unquestionably are the most important of all plants to the human race. The forester, too, is professionally concerned with grasses: Some of them are trees (and important ones), some furnish wood substitutes that compete with lumber, many furnish feed for livestock and game with which the forest administrator actively deals, a few are poisonous, many are useful in stabilizing soils and preventing erosion, some are planting-site indicators, some harbor or support insect, rodent, and fungus pests which injure or otherwise affect the forest, some furnish a fire hazard or interfere with tree seedling germination.

Because of its bulk, the book (unusual for government departmental publications) is neatly bound in green linen. There is an introduction covering varied economic uses of grasses, their distribution, morphology, classification, and nomenclature. This is followed by keys and descriptions of the 2 subfamilies, 14 tribes, 159 genera, and 1,100 species of the United States grasses, whereof 44 genera and 151 species are introduced. The author expresses appreciation to the U. S. Forest Service for its coöperation in furnishing range extensions and other information concerning far-western grasses.

The International Rules of Botanical Nomenclature have been adopted. As it has been customary in past Department of Agriculture publications to use the American Code, there has resulted a number of important changes in generic names. For example, *Aira, Buchloë, Cynodon, Deschampsia, Digitaria, Glyceria, Hierochloë, Holcus, Lamarckia,* and *Setaria* now dispossess, respectively, the American Code names *Aspris, Bulbilis, Capriola, Aira, Syntherisma, Panicularia, Torresia, Notholcus, Achyrodes,* and *Chaetochloa.*

A noteworthy feature of the book is the increased attention paid to English names. In order to obtain proper correlation with the English nomenclature of western range grasses used by the U. S. Forest Service this phase of the work was, to a large extent, intrusted to this reviewer, working under the close supervision of Dr. Frederick V. Coville of the Bureau of Plant Industry, the foremost living American

student of English plant names. The manual publishes for the first time a considerable number of English grass name novelties, e. g. bristlegrass as a generic name for *Setaria;* fluffgrass and satintail, admirable inventions of Dr. Coville for *Triodia pulchella* and *Imperata hookeri,* respectively; and this reviewer's crinkleawn and semaphore-grass for *Trachypogon montufari* and *Pleuropogon,* respectively.

It will be noted, on comparing the systematic framework of the grass family with that shown in the same author's 15-year-old "Genera of Grasses of the United States" (U. S. Dept. Agr. Bul. 772) that there is fairly general agreement. However, the two subfamily names have now been changed to Festucoideae and Panicoideae from Poatae and Panicatae, respectively; Bomboseae becomes Bambuseae, and the tribe Nazieae becomes Zoysieae (due to a change in name of the type genus and not to any disrespect, as the superficial might suppose, to Der Reichsführer!).

An outstanding feature of this book is the copious line-drawings. Each species is illustrated with a figure that shows at least the spikelets, the comparative size according to life, and (what is novel and significant from a scientific standpoint) a notation as to the exact herbarium specimen from which the drawing was made. The spikelet drawings are all by Dr. Hitchcock's colleague, Mrs. Agnes Chase —an insurance of scholarship and trustworthiness — and the admirable habit drawings are by Mrs. Mary Wright Gill and Miss Edna May Whitehorn. Dotted distribution maps are given for all species whose range is at all complicated. Diacritical marks indicate the accentuation of the generic and specific names and the differentiation of separately accented vowels from diphthongs. The restoration of the old symbols for annual and perennial is to be commended. Brief economic notes are given for outstanding species; those on native western range plants are based on information furnished by the Forest Service. The duplication of authorities in such names as *Trisetum aureum* (Ten.) Ten. seems a bit pedantic.

The synonymy, whose compilation is patently the result of many years of arduous labor, is put together near the end of the volume and covers 213 pages of 8-point type, the accepted names in boldface. This list of synonymy also serves in lieu of a bibliography. There is a 5-page list of persons for whom United States grass genera, species, and varieties have been named, with the grasses for which they are eponyms. The name of a well-known forester, the late W. W. Ashe, appears in this list, but only two women, Miss Alice Eastwood and Miss Edith Ross. An embarrassing error appears in this list in indicating that Prof. Aven Nelson (still very much alive) died in 1934. In conclusion, there is a 6-page glossary of botanical terms used in the text, followed by a lengthy index of plant names, Latin and English.

It seems cause for regret that more active recognition was not given to Mrs. Chase in view of the immense labors she performed in connection with the synonymy, keys, illustrations, editing, and proof-reading of this epoch-making book.

W. A. Dayton,
Forest Service, Washington.

An Outline of General Forestry. By Joseph S. Illick. *Pp. 259. Illustrated. Barnes and Noble, New York. 1935. Paper binding, $.75; cloth, $1.50.*

It was perhaps inevitable that some one should do for forestry what has already been done for most of the arts and sciences; that is, write a general outline. It is, in this reviewer's opinion, fortunate that Dr. Illick undertook the job. For out of his many years of teaching, research, and administrative experi-

ence has emerged a book that is as comprehensive as it is convenient, as authoritative as it is analytical.

To any conscientious observer of forestry progress during the past three years it is evident that the written record of it, at least that portion appearing in book form, has lagged far behind the latest developments. This outline in a sense "catches up" with those developments. It surveys the entire field of forestry and forest conservation from their beginning in this country and summarizes their up-to-the-minute status.

Although addressed primarily to forestry students, the book will doubtlessly prove extremely useful to practicing foresters as a yardstick to measure past accomplishments and to chart future directions. Under the thought provoking approach employed by Dr. Illick old concepts of forestry take on new significance. For example, he says, "Organized forestry has been developing for more than a half of a century in the United States. During this period it has come to have a wide range of meanings. Among these different meanings are: A subject to study; a science to foster; an art to practice; a technique to use; a business to handle; a problem to solve; a movement to support; a career to choose."

Among the numerous virtues of this excellently assembled book two particularly should be mentioned: the skillful manner in which the various phases of the subject are organized and presented, and the carefully selected list of references that follows each chapter. The volume is thoroughly documented and concludes with a useful index.

Formerly state forester of Pennsylvania, Dr. Illick is now professor of forest management at the New York State College of Forestry at Syracuse University. Because the present reviewer had the good fortune to study under Dr. Illick in the class room and the honor to serve under him in the Pennsylvania Forest Service, the statement that follows may at first sight appear to be favorably influenced by that association. However, judging the volume strictly on its merits as a contribution to the literature of forestry, this reviewer honestly believes, and therefore has no hesitancy in saying, that few books in recent years give as much value for the customer's money as this one.

HENRY E. CLEPPER,
Dept. of Forests and Waters.

The Duke Forest. A Demonstration and Research Laboratory. By Clarence F. Korstian and William Maughan. *Duke Univ. Forestry Bull. No. 1. 74 pp. 25 fig. and 4 maps. Durham, 1935.*

"This bulletin describes the Duke Forest as it existed when established in 1931, discusses the objectives and policies being followed in managing the property, and reviews the progress already made in operating it as a demonstration and research forest." The introductory sentence of the authors tells accurately and concisely what the bulletin covers. It is the first of a new forestry series now initiated by Duke University and quite appropriately is devoted to the superb demonstration forest lying adjacent to the University and within which much of the future research work will be undertaken.

The Duke Forest is unique among college and university demonstration and research forests so far featured in publication in that it is located within the southern forest and is covered in large part by stands of shortleaf and loblolly pines either pure or mixed or in association with hardwoods. Among its important hardwood species are red gum and yellow poplar.

The major objectives of management for the Duke Forest are clearly stated as follows: The forest should serve "as an

area for the development and demonstration of forestry practices, as an experimental forest for research in the problems of timber growing and in the sciences basic thereto, and as an outdoor laboratory where field work can be carried on by forestry students."

Essentially these are the primary objectives of demonstration and research forests in all parts of the country. However, the section of this bulletin where these objectives are elaborated and quite fully discussed is especially well done and merits careful reading by all those interested in demonstration and research forests. Sections on "Subdivision of the Forest" and "Forest Records" should also prove stimulating to all men actually in charge of forest properties.

Among protection activities the details of the fire control system and outbreaks of bark beetles (*Ips* and *Dendroctonus frontalis*) are of special interest.

A wide variety of silvicultural operations, including nearly all those customarily used, are being applied. Fortunately an excellent market for pine fuel wood exists, which makes possible the use of an intensive thinning policy. Pruning of pine is carried up for two 16-foot logs, and the practice is being extended to the more valuable hardwoods.

The bulletin is well written and gotten out in first class style. A series of excellent photographs, carefully selected as to subject matter, adds much to the text and in itself clearly tells almost a complete story. The colored forest cover maps are unusually well executed; indeed, only those who have tried the production of this type of map can fully appreciate the results here attained.

The authors are to be congratulated on their success in launching a new bulletin series and in introducing the Duke Forest formally to the forestry profession. It may be predicted, because of the favorable climate, excellent opportunities for selling forest products, and the wealth of valuable timber trees of surpassingly rapid growth rate, that the Duke Forest will advance faster toward the goal of a demonstration forest—one which really demonstrates—than many of the forests started earlier but under less favorable conditions.

R. C. Hawley,
Yale University.

Chronica Botanica. Vol. 1, April, 1935. Edited by Fr. Verdoorn. *447 pp. Editorial and Publishing Office: P. O. Box 8, Leiden, Netherlands.*

This publication marks a new departure in bringing together in one annual volume a current record of pure and applied plant science and a review of important researches in agronomy, forestry, horticulture, microbiology, soil science, and agricultural chemistry in addition to covering the main branches of botany itself. Also the yearbook contains news of the past year such as appointments, obituaries, and anniversaries and notes about future events. It contains reports and notes on societies and congresses. Although most of the information is obtained from the answers to questionnaires sent out each year to all institutions and societies, a staff of collaborators is also maintained.

The *Chronica Botanica* covers a field not hitherto preempted, conflicts with no established periodical, supplements those already in existence, and should, by its very nature, encourage international cooperation.

Of special interest to foresters is the "Congress (International) de Sylviculture et du Carbone-Carburant près l'Exposition Universelle et Internationale de Bruxelles" held in Brussels, Belgium, July 26 and 27, 1935; the Empire Forestry Congress held in Pretoria, South Africa, in September, 1935; the meeting of the International Association of Wood Anatomists held in Amsterdam on the occasion of the sixth Interna-

tional Botanical Congress in Amsterdam, September 2-8, 1935; and the International Congress of Silviculture to be held in Hungary in 1936 near the time of the Congress of the International Union of Forest Research Organizations, although not in conjunction with it.

Many items of international interest are to be found under the different countries. For example, the death of Dr. Adolph Cieslar, who earlier held the chair of forest production in the agricultural academy at Vienna, Austria, is reported as having occurred in July, 1934. Also Professor Heinrich Weber of the forest research institute of Baden at the University of Freiburg, founder of the Forstliche Rundschau and for many years editor of *Allgemeine Forst- und Jagdzeitung*, died at the age of 66. It is reported that Dr. Hans Burger has succeeded Professor Henri Badoux as director of the federal institute of forest research at Zurich, Switzerland.

Most of the forestry institutions in the United States are included. The Society of American Foresters is listed by name only, presumably because pertinent information was not supplied.

The volume will undoubtedly be very useful to many who desire to keep abreast of international developments in any of the branches of plant science, whether or not they are engaged in foreign exchanges.

C. F. Korstian,
Duke Forest.

Zur Anatomie und Physiologie der Zuwachszonen und Jahresringbildung in den Tropen. (The anatomy and physiology of accretion zones and annual ring formation in the tropics.) By C. Coster. *Ann. Jard. Bot. Buitenzorg. Vol. 37, pp. 49-160; vol. 38, pp. 1-114, Plates I-VI. 1927.*

Though Coster's paper was published several years ago, it came to the reviewer's attention only within the past couple of years, and since apparently it is not very well known, it seems worth while to invite attention to it even at this late date. It is distinctly not an ephemeral contribution. Based on anatomical examination of increment-borer cores and cross-sections of stems, with collateral observations of leaf activity and supplementary experimental studies, this detailed report presents a most illuminating picture of growth conditions in a tropical region. The paper is divided into five parts: I. Introduction, Methods, Climate (pp. 50-58); II. Earlier Investigations in the Tropics (pp. 58-63); III. Observations (tropical species, pp. 63-130, temperature-zone species, pp. 130-160); IV. Summary of Observations (pp. 1-31); V. Experimental Part (pp. 31-105). Six pages are devoted to a 12-point summary, while a bibliography occupies three pages.

The studies were made in three different localities in Java (7° S. Lat.): at Buitenzorg and at the mountain botanical garden of Tjibodas, in the western end of the island, and at the coast village of Toeben in the eastern part. The author describes the western section of the country as marked by a relatively equable climate, with considerable rainfall even in the driest months, although strictly speaking the climate is not constantly wet. In contrast, the eastern end has a definite dry season (June-November), being technically a dry monsoon region. More than 80 species of woody plants were included in the study, some native and some exotic.

Among the interesting observations recorded is the prevalence in the Tjibodas vicinity of evergreenness in exotic species which are normally deciduous in their native lands, for example, Eurasian chestnut (*Castanea sativa*), apple (*Pirus malus*), peach (*Prunus persica*), an alder (*Alnus maritima*), and American elder (*Sambucus canadensis*). This evergreenness takes various forms. In general, while some part of the tree is constantly

growing, individual branches of broadleaf trees experience a period of dormancy from time to time. The plants observed of alder, rose, and elderberry, however, grew continuously on all uninjured branches. (This, it may be mentioned, is suggestive of the observations of essentially continuous growth in Monterey pine (*Pinus radiata*) and Monterey cypress (*Cupressus macrocarpa*) made in California at the Coastal Laboratory of the Carnegie Institution of Washington.[1])

In the case of bald cypress (*Taxodium distichum*), the author observed that the cambium seemed to be always active throughout the year, though the individual branches showed a striking independence of one another, the wood being in different stages of development on different parts of the tree. It is to be noted that in the comparatively mild and equable climate of Carmel and Monterey, in Monterey County, California, the bald cypress shows a marked tendency to retain green leaves throughout the year. Nevertheless a small tree under close observation at Carmel seemed to experience a true dormant period during cold weather.[2]

One of the most fascinating of the trees studied by Coster was an 85-year-old European beech (*Fagus sylvatica*) growing on a mountain top at an elevation of 3,000-odd meters above sea-level in a very unfavorable climate. In spite of its age it was only a meter in height, but spread to a length of 4 meters and a width of 2½. It consisted of a mass of branches at first sprawling sinuously along the ground, but becoming more or less elevated at the outer ends. These branches were covered deeply with moss, in which adventitious roots would develop during rainy periods, mostly dying back in dry weather, although a few of the branches had established permanent roots. Coster notes that the top gave the appearance of having been shaved off [which is the aspect presented by redwood (*Sequoia sempervirens*) and California laurel (*Umbellularia californica*) in exposed situations on the California coast and by trees of other timberline sites]. Whenever observed, the appearance of this beech was much the same, part of the crown being dry with persistent dead leaves, some of the smaller branchlets leafless with dormant buds, and other branches with full-grown leaves (of which some were beginning to turn color), and finally a few branchlets with opening buds. The author's description of the closely interwoven mass of small twigs with dead ends, which he compares with pasture beeches in Europe kept stunted by grazing animals, suggests also the appearance of wind-dwarfed redwoods on the coast of Califonia.[3]

In eastern Java there are found near together species which are leafless for a long time during the dry season, species which are bare for only a short time, and

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[1] *See:* Macdougal, D. T., and Shreve, F. 1924. Growth in trees and massive organs of plants. Carnegie Inst. Wash. Pub. No. 350, pp. 7, 8, 11, 12;
MacDougal, D. T. 1929. Trees as recorders, *in* Reports of conferences on cycles, Carnegie Inst. Wash., p. 30;
MacDougal, D. T. 1930. Lessened growth periods and continuous growth. Proc. Amer. Philos. Soc. Vol. 69, pp. 329-345 (especially 340, 342-343);
Haasis, F. W. 1932. Further records of essentially continuous growth in trees. Carnegie Inst. Wash. Year Book 31, pp. 196-197;
Haasis, F. W. 1934. Diametral changes in tree trunks. Carnegie Inst. Wash. Pub. No. 450, pp. 46, 47.

[2] *Cp.* Haasis, F. W. 1932. Growth and diurnal fluctuations in a deciduous gymnosperm. Carnegie Inst. Wash. Year Book 31, p. 199;
Haasis, F. W. 1934. *Loc. cit.*, p. 57, fig. 14.

[3] *See* Haasis, F. W., 1934. *Loc. cit.*, p. 33. Pl. 2, 4.

evergreens, the last with two or three growth variations. (These three types may be approximately matched in the eastern United States, for example, by the early-deciduous walnuts, the late-deciduous oaks, and pines, a cold dormant period taking the place of the dry dormant season of Java.) But when the deciduous species of eastern Java are grown in western Java the growth program is upset, the rest period becoming irregular, sometimes to such an extent that the tree is never wholly bare, but only a part of the branches shed their leaves at a time. Again, a tree which normally loses its leaves at yearly intervals may become deciduous at 8-month intervals.

Although other writers have reported growth in thickness beginning even before the opening of the buds,[4] Coster did not observe this to be true in any of the species he studied.

It was Coster's observation that, curiously enough, not many tropical species fail to form accretion zones in Java, even under uniform external conditions.

Coster makes special mention of *Peltophorum ferrugineum*, one of the *Leguminosae*, because of the occurrence at times in this species of exceedingly irregular accretion zones. As looked at in cross-section, some of these ramified into two or three branches, which again united or became indistinguishable in the tissues of the stem. Here we have another suggestion of conditions in the Sequoias, whose growth layers may sometimes be quite different at various points in the tree.[5]

Besides its value as a report on growth activities in the tropics, this thoroughgoing discourse will undoubtedly help to explain observations made in temperate regions. It may even be that some of our current concepts should be modified in view of Coster's findings. The author, indeed, warns of the risk of making too sweeping generalizations on the basis of observations in the Temperate and Frigid Zones, and emphasizes the value of conducting studies in a tropical region where a wealth of diverse forms is to be found. It is to be noted that for tropical conditions Coster prefers the term *growth* (or *accretion*) *zone* (*Zuwachszone*) to *annual ring* (which, in the reviewer's opinion, we have adopted a little too thoughtlessly, following it with the phrase *false ring*, of recondite etymology). This paper is well worth the perusal of all those whose work deals with the study of growth layers, physiologists as well as morphologists.

FERDINAND W. HAASIS,
Carmel, Calif.

Klucz do oznaczania wazniejszych szkodliwych owadow lesnych. (Key for the identification of important forest insect pests.) By Dr. Marjan Nunberg. *288 pp., 359 illus. Serja B., No. 1, Instytut Badawczy Lasów Panstwowych W. Warzawie, 1935.*

This compact little volume, recently published by the Polish Forest Research Institute, provides the Polish forester with a useful key for identifying the more important insects which attack forest trees.

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[4] *Cp.* Lodewick, J. E. 1928. Seasonal activity of the cambium in some Northeastern trees. N. Y. State College of Forestry Technical Pub. No. 23, pp. 11-13;
Haasis, F. W. 1934. *Loc. cit.*, p. 57.

[5] *Cp.* Fritz, E., and Averell, J. L. 1924. Discontinuous growth rings in California redwood. Jour. of Forestry. Vol. 22, No. 6, pp. 31-38;
Huntington, E. 1928. The secret of the big trees, p. 14;
Haasis, F. W. 1933. Shrinkage in a wind-dwarfed redwood. Jour. of Forestry. Vol. 31, pp. 407-412 (especially 409-410);
Haasis, F. W. 1933. Growth of a redwood (*Sequoia sempervirens*) subsequent to decapitation. Carnegie Inst. Wash. Year Book 32, pp. 191-192.

The introductory portion of the book consists of 13 pages in which are described briefly the general characteristics and anatomy of insects, the distinguishing characteristics of each order of insects, and the construction and use of the key which follows.

The key proper covers some 230 pages and is divided into sections corresponding to the common forest trees species of central Europe. In each section there are described in systematic order the insects which attack that tree species. The characteristic feature of the insect and the damage it does are covered in each case. The key is well illustrated, chiefly with photographs showing the insect, often its various stages, and typical views of the type of injury caused by the insect. Approximately 100 pages are devoted to insects attacking pine, after which follow briefer sections of variable length which cover the insect enemies of spruce, fir, larch, oak, beech, ash, elm, maple, birch, hornbeam, poplar, linden, alder, and willow.

Following the key proper is a list giving the systematic classification of each insect mentioned in the text.

The value of this publication to American foresters lies not in the text, since it is written in a language not generally known and covers species of trees and insects which are not common in this country, but in its indication of what a handy pocket manual of forest tree insects ought to be like. The reviewer believes that if there were available in this country, probably on a regional basis, similar manuals embodying equally good typography and photographic illustrations and giving as succinct descriptions, the great army of foresters now in the field who are not specialists in entomology would be greatly aided in identifying the forest insect pests which they encounter in their work.

Paul O. Rudolf,
Lake States For. Exp. Station.

Some American Trees. An Intimate Study of Native Ohio Trees. By William B. Werthner. *The Macmillan Co., New York, 1935, pp. 398, figs. 263.*

"Of the making of many books," quoth the wearied Preacher-King of old, "there is no end,"—and tree books are no exception. This one, however, is "different." It is, in essence, a series of essays on the trees of Montgomery County, Ohio, the posthumous work of Dr. William B. Werthner (1855-1929) finished by his widow, Evangeline Hippard Werthner, "commissioned" by Col. Edward A. Deeds, and dedicated to the latter's two sons, Charles Walton Deeds and the late Edward A. Deeds, Jr. There is a foreword by Dr. Raymond Kienholz of the Forestry Department of the Connecticut Agricultural Experiment Station, who served as technical editor.

The author was born in Dayton, Ohio, the son of a German Baptist clergyman. He was educated at various schools, Harvard University, the University of Berlin, and Wittenberg College. He served in the high schools of Dayton for about a half century as assistant principal, principal, and teacher of German, botany, and the natural sciences, and after his retirement in 1925 was made educational director of the Dayton Public Museum. He was well and favorably known as a teacher and lecturer, and was the author of a number of historical sketches, of a botany notebook, and of a geographical reader "How man makes markets."

In 1922 Dr. Werthner set about to discover what trees are either native or naturalized in his community. This was not an easy task, as the original forest had largely disappeared—due to the hand of man in a region at once intensively industrialized and farmed. By patient searching of fencerows, farm corners, natural portions of city parks, and the like he has compiled a list of 89 native and 15

"immigrant" trees for his area. These species he has described, annotated, and photographed. His treatment, while scientifically accurate, is essentially that of the nature-lover and poet; the pages breathe of fresh woods and brown earth rather than of the laboratory. Dendrology, wood science, ecology, phenology, economics, Indian lore, birds' nesting places, historical and other anecdotes, boyish adventures, etymologies, and other factual material are woven with the numerous poetical quotations into a literary fabric at once instructive, entertaining, and with a distinctive charm of style. The body of the book consists of an introduction concerning the tree as a living thing, its ecology, reproduction, and relation to men; a chapter on the forests of Montgomery County, followed by 30 chapters on as many tree families, and an index to Latin and English tree names. A distinctive feature of the book is the tabulations entitled "Earmarks" whereby the outstanding field-identification characters of the trees are presented. Typographically, the book (which retails at $5 a copy) is a thing of beauty. The paper is the envy of a reviewer accustomed to content himself with government bulletin material, and is admirably adapted to show to best advantage the beautiful photographs, all by the author himself, which profusely ornament and clarify the text. The book is refreshingly free from inaccuracies, typographical and otherwise; in fact, this reviewer has thus far noted only one error (and that in an *obiter dictum*) where (on p. 17) the area of England is given as 200,000 square miles.

W. A. Dayton,
Forest Service, Washington.

CORRESPONDENCE

Tharandt, Germany,
August 17, 1935.

DEAR PROFESSOR CHAPMAN:

With great pleasure and pride I have received your notification that the Society of American Foresters has elected me as a Corresponding Member. I wish first to convey to you as President of this illustrious Society my sincere thanks for the honor conferred upon me, and I ask you to express my thanks to the Society.

You may be assured that I will do my best to help whenever and wherever possible to forward the aims of the Society, which always have been and in the future will be even in a higher degree of the greatest importance for the welfare of the American forests in especial, and world forestry in general. During my stay in the United States I had occasion to study some of the major problems of forestry on the ground, and with the greatest interest I learned the extremely difficult conditions under which American foresters are doing their important work. Furthermore I saw the remarkable progress which has been achieved in several lines of forestry in recent years.

But I have been particularly happy to make close personal contact, and I dare say friendship with, many of the American foresters. I once more realize, as I have often realized in many countries of the globe, that foresters are a union and a brotherhood of a unique character.

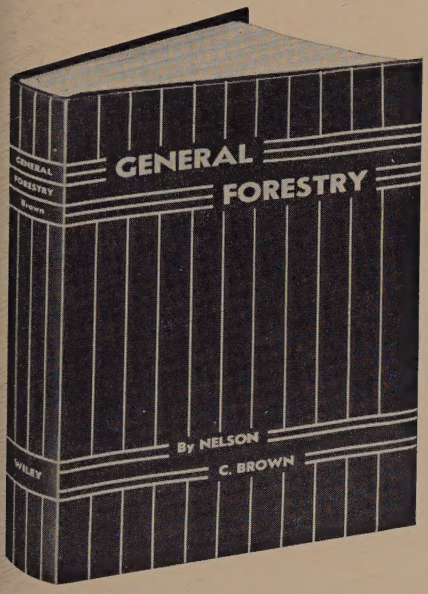
The frontier may have gone, but the spirit of the true pioneer will now be needed more than ever to face with a broad vision the urgent necessities of our time and to carry out with unbroken spirit that, which is needed for us and the unborn generations.

You will, dear President, find me always ready to help in this spirit where I can!

I am, my dear colleague,

Very sincerely yours,

FRANZ HESKE.



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This new book offers a thorough treatment of all phases of the general forestry program in the United States. Among the topics covered are the history, economics and importance of forestry, the province of the field of forestry, the training of men for the profession, and some of the professional requirements, the part that forestry may play in watershed protection, the prevention of erosion and gullying, the growing of adequate timber supplies, provision for increased recreational facilities, and particularly the social as well as economic implications of forest conservation.

Important features of the Civilian Conservation Corps program, the Tennessee Valley Authority, the Soil Conservation Service, the Great Plains Shelterbelt project, the new Public Domain Administration, increased public acquisition of forests, and the National Recovery Administration, as far as they pertain directly to forestry, are discussed.

This is the only general forestry book published which includes actual photographs of the CCC camps at work and play. The content is fully up to date, and is backed by the weight of authority. Professor Brown has traveled extensively all over the United States, gathering his data first-hand from the National Forests and National Parks, lumber, pulp and paper companies, and other enterprises. The book is as a result practical in its outlook, yet not too technical for the beginner. It should be of great value to the graduate forester, the student or the CCC worker.

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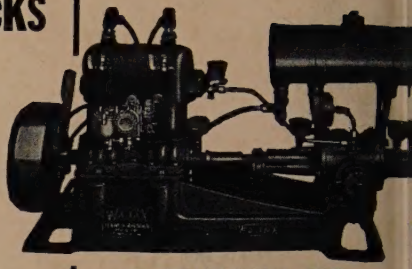

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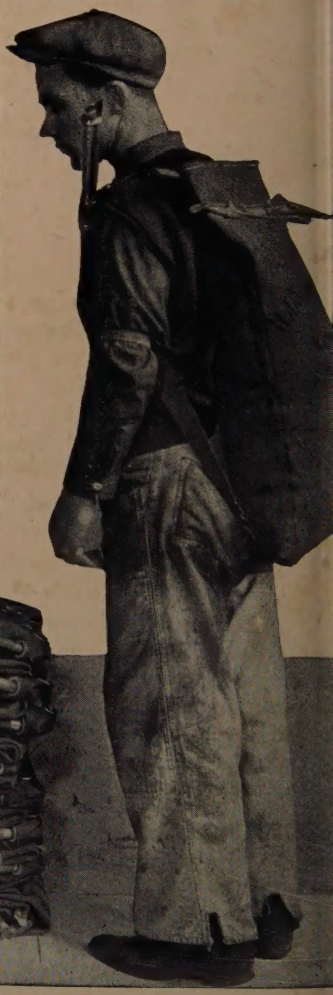

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